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30 Russell Square,
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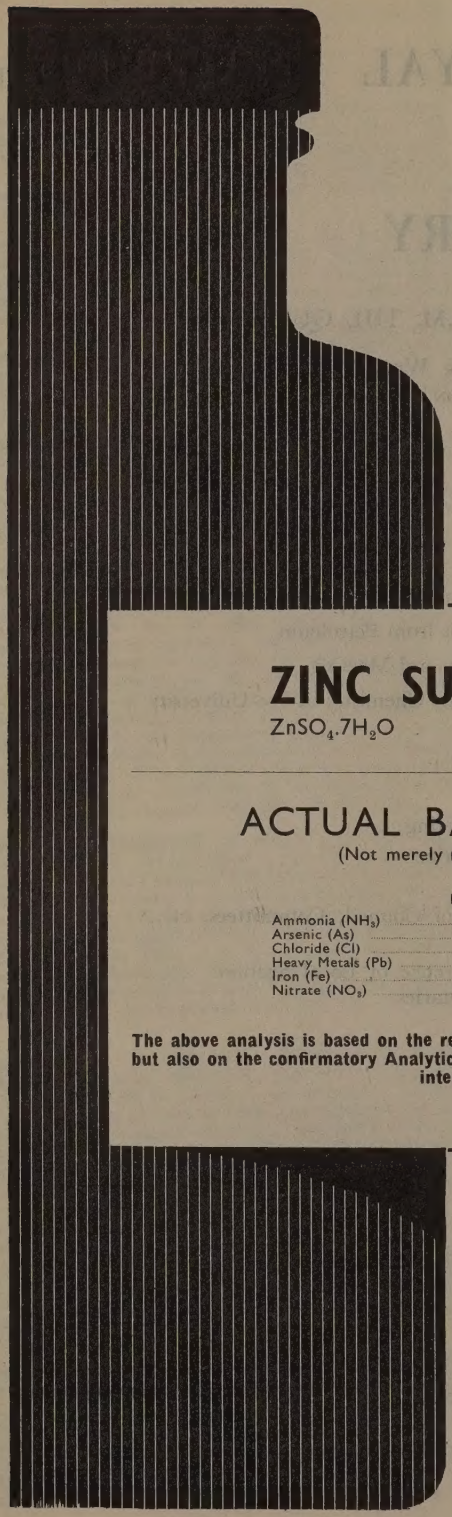
THE ROYAL INSTITUTE OF CHEMISTRY, 30 RUSSELL SQUARE, LONDON, W.C.1

Langham 3482



Judactan

analytical reagents

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ZINC SULPHATE A.R.

$ZnSO_4.7H_2O$ Mol. Wt. 287·56

ACTUAL BATCH ANALYSIS

(Not merely maximum impurity values)

Batch No. 68902

Ammonia (NH_3)	0·0008%
Arsenic (As)	No reaction
Chloride (Cl)	0·0001%
Heavy Metals (Pb)	0·0002%
Iron (Fe)	0·00001%
Nitrate (NO_3)	0·0001%

The above analysis is based on the results, not of our own Control Laboratories alone, but also on the confirmatory Analytical Certificate issued by independent Consultants of international repute.

Chemists all over the world are grateful for our care. Our policy of having independent analyses made gives chemists added confidence in their work. Why not compare the actual batch analysis shown with the purities guaranteed by the specifications to which you normally work? You will find the comparison of interest and almost certainly of help to you.

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ANNUAL CONFERENCE—SOUTHAMPTON 20-22 April

For many years now it has been possible to report that the Anniversary Meetings, and latterly the Annual Conferences, have been very happy and successful events. The Meetings this year at Southampton, by invitation of the Mid-Southern Counties Section, were exceptional in that most of those taking part had previously regarded Southampton as a place to pass through rather than as a very pleasant south-coast town in which to stay, with its garden-city approaches, a feeling of spaciousness, a modern shopping area, and a civic centre of which any town could be justly proud. Most members stayed centrally in the hotels, with daily visits out along The Avenue, through Southampton Common, to the University two miles to the north, where the business meetings were held. Others, who stayed at Chamberlain Hall, the post-war University Hall of Residence for women, had the advantage of being near the University, but made their daily journeys to the Civic Centre for the evening functions. The Reception Office and Information Centre were conveniently situated in the University Staff House (West Building). We are indeed grateful to the University authorities, and especially to the Vice-Chancellor, Dr D. G. James, for so freely offering the facilities of various buildings and the canteen for the three days.

Lanchester Building with (*lower right*) the Engineering Lecture Theatre

THURSDAY, 20 APRIL

The first event was a well-attended Symposium on 'Chemicals from Petroleum' (p. 209). This was held in the new Engineering Lecture Theatre designed by Sir Basil Spence on the cantilever principle. It contained many novel features, not the least impressive being more or less complete acoustic isolation from the rest of the building and from the clanging of steel and hooting of lorries outside and even immediately below the theatre at the entrance to the Lanchester Building.

Alternative events were a Coffee Party, given by the Section to the ladies, at Connaught Hall, the University Hall of Residence for men. We are grateful to the Warden, Dr J. N. Ball, for his co-operation. In the afternoon there were visits to Southampton Gasworks (equipped to convert refinery gas into town's gas by cyclic catalytic processes); John Wyeth & Bros Ltd, Havant, pharmaceutical manufacturers; Mullard Ltd, for the manufacture of semi-conductor devices; Portsmouth Dockyard and H.M.S. *Victory*; and a coach tour of the Meon Valley.

In the evening a Civic Reception was held at the Guildhall, by kind invitation of the Mayor and Corporation of Southampton. Guests were received by the

By courtesy of Southern Newspapers Ltd

Mr E. LeQ. Herbert with Mrs Herbert receiving Sir William and Lady Slater. In the background are the Mayor and Mayoress of Southampton

Mayor and Mayoress, Councillor W. Greenaway, J.P., and Mrs Greenaway, together with the retiring President, Mr E. Le Q. Herbert, and Mrs Herbert. After a short speech of welcome by the Mayor, there was dancing to the music of Bert Osborne and his orchestra and a buffet supper was provided. Certain well-known regular supporters of the Annual Conference seemed to be missing, but they had migrated to a lower floor where additional facilities were available. (In Southampton, of course, Above Bar and Below Bar have a special significance.)

FRIDAY, 21 APRIL

The Annual General Meeting of the Institute, which was the main business meeting, is fully reported below

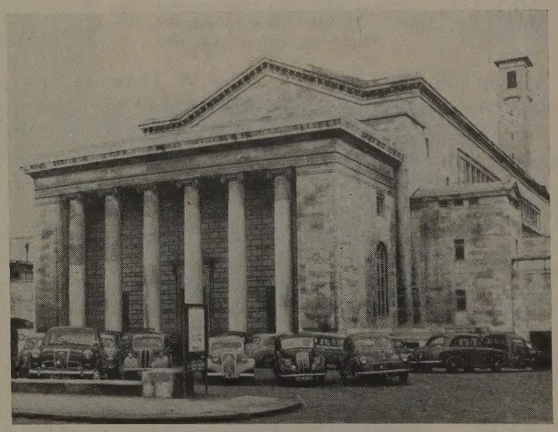
(p. 211). After an interval for coffee, a very large audience met in the Assembly Hall to hear Mr Herbert's address on 'Catalysts for Progress.' Mr Herbert, at short notice, had voluntarily taken the place of the Conference Lecturer, Sir Harold Hartley, who was prevented by the state of his health from fulfilling an earlier promise. In his address, interspersed with commentaries on three film sequences, Mr Herbert dealt with the important social impact of many products of the chemical industry and the ways in which the chemist contributed to the amelioration of life in many parts of the world (*see* May issue, p. 163). He was thanked by Sir Harry Jephcott, *Past President*, in a way that left no doubt as to the impact the address had made.

During this part of the programme the ladies were entertained by a Beauty Demonstration staged by Max Factor Ltd at the Royal Hotel, Cumberland Place. In addition, a Dress Show was provided by six students of the Southampton College of Art, in the Conference Room, Staff House, by courtesy of the College Principal, Mr W. J. Smith, and Miss Norminton.

The afternoon was given up largely to visits and tours. One group was entertained to luncheon by invitation of the Directors of the International Synthetic Rubber Company and then shown over the establishment at Hythe. Another party saw the Marchwood Generating Station, Southern Electricity Board, one of the first stations to burn residual fuel only. Others were taken to the Ocean Terminal for a cruise round the docks and a visit to King George V Dry Dock, or went by coach and launch to the Radar Scanning Tower, from which the shipping in Southampton Water is controlled. There was also a coach tour to Salisbury and its environs, which included a visit to the Cathedral.

ANNUAL DINNER

In the evening of 21 April the Annual Dinner was held at the Guildhall, with the retiring President as Chairman.



Guildhall, Southampton

Mr and Mrs Herbert, with Sir William and Lady Slater, received the guests, who on this occasion included two distinguished men of science, Sir John Russell, O.B.E., F.R.S., and Sir Eric Ashby (together with their Ladies), who were later presented with the scroll of Honorary Fellowship. After the Loyal Toast, the Chairman proposed 'The County Borough of Southampton,' to which Councillor Greenaway replied with unmistakable sincerity. The Toast of 'The Institute' was proposed by the new Hon. Fellow, Sir Eric Ashby, in a brilliant speech that touched a new high note for such occasions. After Mr Herbert had replied, the new President, Sir William Slater, proposed 'The Guests,' to which Dr James, the Vice-Chancellor, replied, expressing among other things the satisfaction felt by the University that it had been selected as a centre for the Conference.

On this occasion we were happy to have as guests, besides those mentioned above, Alderman Mrs G. E. A. Barker (Sheriff of Southampton), Mr A. N. Schofield (Town Clerk), Alderman Mrs M. Cutler, O.B.E., J.P. (Chairman, Finance Committee, Southampton County Borough Council), Dr J. J. Dempster, O.B.E. (Chief Education Officer, Southampton) and Mr H. Jackson Seed (Entertainments and Publicity Officer). Other organizations in Southampton were represented by Mr W. M. Cox, J.P. (President, Southampton Chamber of Commerce), Mr F. T. West, M.B.E. (Principal, Southampton Technical College) and Mr W. J. Smith (Principal, Southampton College of Art). Dr James, together with Mr R. N. M. Robertson (Secretary and Registrar) and Professor R. C. Cookson (Department of Chemistry) represented the University. We were also pleased to welcome Mr G. F. Williams (Managing Director, British Drug Houses Ltd, and President, Association of British Chemical Manufacturers) and Mr L. T. Le G. Burley (Director and Divisional General Manager, British Drug Houses Ltd), our hosts on the following evening. Other Societies' representatives included Professor Sir Alexander Todd, F.R.S. (President, The Chemical Society), Lt-Col F. J. Griffin (General Secretary, Society of Chemical Industry), Dr F. A. Robinson (Hon. Treasurer, The Biochemical Society), Dr A. J. Amos (President, Society for Analytical Chemistry) and Mr John Wilson, C.B.E., M.C. (President, British Association of Chemists).

SATURDAY, 22 APRIL

The remaining business meeting, the 44th Conference of Hon. Secretaries of Local Sections, was held during the morning in the Board Room of the Institute of Education (*see* p. 236).

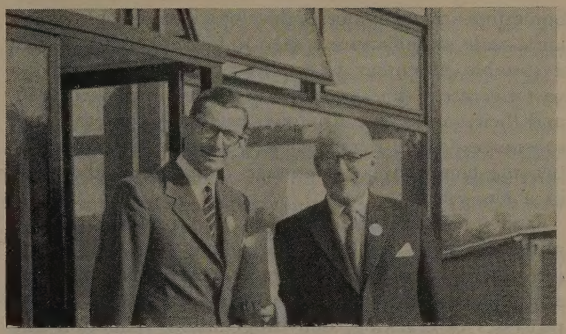
Other events included a morning Sherry Tasting, arranged by John Harvey & Sons at the Royal Hotel, Cumberland Place. There were all-day visits and tours to the refinery of the Esso Petroleum Company Ltd at Fawley, to the Atomic Energy Establishment, Winfrith (including luncheon at Lulworth), and to the Isle of

Wight by steamer and coach, including Alum Bay and The Needles in the itinerary.

In the evening a final reception and dance was provided by kind invitation of the Directors of the British Drug Houses Ltd at the Polygon Hotel. Guests were received by Mr and Mrs Williams and Mr and Mrs Burley. Brian Gorman and his Music, well-known to local residents, made the evening a delight for those who danced and those who sat out. Special thanks are due to the Company for their friendly welcome and liberal hospitality.

Members will wish to express appreciation to those members of the University staff who made real contributions to the success of the meetings, though behind the scenes, and in particular to Mr J. V. Smith, Assistant Secretary and Technical Officer, who was responsible for many of the detailed arrangements, and to Miss I. K. Oades and Miss M. I. Ward, Warden and Vice-Warden of Chamberlain Hall.

Opinions as to which Annual Conference has been the most successful are naturally influenced by local pride and personal loyalties, but there was general agreement among all who took part in the Southampton meetings that they were among the most pleasant and most interesting that could be remembered. This was largely due to the efficiency, enthusiasm and hard work of Mr D. H. Bell and Mr T. F. McCombie, respectively Chairman and Honorary Secretary of the Mid-Southern Counties Section, and Dr R. E. Parker, Member of Council for the District.



Mr D. H. Bell, Chairman of the Mid-Southern Counties Section (*right*) and Mr T. F. McCombie, Hon. Secretary of the Section

Aided by other members of their Committee, these Honorary Officers shared the heavy responsibilities of preparing an extensive and varied programme and, even more important, of making sure that everything went smoothly. The best tribute that can be paid to their notable achievements is to report that the only criticism of their efforts heard during the Conference was to the effect that they might have arranged for better weather.

SYMPOSIUM ON CHEMICALS FROM PETROLEUM

Mr E. Le Q. Herbert opened the proceedings in a few words, indicating that today no more suitable place than Southampton could be found for a symposium on this theme.

In the opening paper, Dr N. Gaylord, of the Polymer Research Institute, Brooklyn, spoke of the new area of polymerization in the olefin and diolefin field opened up by the application of Ziegler–Natta catalysts, and the sensitivity of the polymerization mechanism to the presence of minor components in the catalyst. As one example he took the 1 : 2-polymers of butadiene and isoprene with their unsaturated side-chains, which can be all on one side of the chain or alternating. Thus both forms of the *cis*- and *trans*-polymers can, by further reaction, give a great variety of products of varying block structure, the properties of the products depending largely on the sizes of the blocks. Work on such topics is proceeding so rapidly that we may expect some 50 new 'rubbery' substances to be on the market in the next few years.

In general, the catalysts have two components, AlX_3 for the reaction and $TiCl_4$ for orientation, the latter acting in a reduced form in the presence also of some alkyl titanium halides. The AlX_3 is adsorbed on the surface and must be present in excess. The reaction medium is of equal importance, for the polymer, as it forms, must be removed from the surface or the reaction stops. The definite geometrical requirements in the catalyst may be easily altered, *e.g.* by polar impurities, and this will change the course of the reaction. In some instances, if the iodide is used instead of the chloride a *cis*-1 : 4 product will be obtained in place of a *trans*-1 : 4; and a lithium aluminium halide with $TiCl_4$ will give a 1 : 2-product. By changing the Al/Ti ratio the structure of the product can again be altered. With this new-won flexibility it was expected that, in a few years, we should know which structures would give materials with properties better than natural rubber.

To end his masterly high-speed review of recent studies, Dr Gaylord surveyed the work on some remarkable C_{12} ring polymers. Besides these, heptadiene and hexadiene could be made to yield polymers with cyclohexane and cyclopentane rings, and these by dehydrogenation gave polymers with benzene rings.

In the second paper Mr L. Holliday, research and development manager, Plastics and Rubber Division, Shell Chemical Co. Ltd, gave an account of 'Monomers from Petroleum,' required on the large scale particularly by the plastics and polymers manufacturers. Not always is it obvious how a polymer can best be made.

Sometimes the polymer is developed to a point where large-scale manufacture is seen to be desirable and then a suitable monomer is required. There has been a vast increase in the production of monomers since 1940, and their variety is continually extending; several more substances—once regarded as somewhat esoteric—will become common large-tonnage commercial chemicals in a few years.

The manufacturing problem is to produce reactive molecules from relatively unreactive feedstock by the introduction, usually, of oxygen, chlorine or nitrogen, and where possible by means of the more normal processes of cracking, dehydrogenation, oxidation and addition. One of the main fields of current research on monomer production is the thorough exploration of one-step dehydrogenation processes; work on oxidation and polymerization reactions is also of great importance. Cracking processes generally yield olefins in quantity, with less ethylene than propylene and butylene, the proportion of ethylene varying inversely with the average molecular weight of the feedstock. Acetylene and propylene have already become important and will become more so. Alkyl and aryl butenes are produced generally by dimerization. The usual starting-point for the substituted di-olefins is n-butene, the selection of catalysts for the reactions being crucial. Butadiene, also of wide use, is obtained from butane by dehydrogenation steps. The less usual monomers are prepared where possible by addition to olefins, chlorination processes being used when convenient as they are relatively cheap.

To conclude the morning session, Mr K. C. Bryant, research manager, Monsanto Chemicals Ltd, gave a paper of a different kind entitled 'New Methods of Polymerization.' He drew together the threads of work being done in many different fields, and gave a very good impression of the manner in which workers on the fringe of new frontiers have to feel their way to new knowledge and fresh conceptions. It is hoped to publish the lecture in full in due course.

The new methods of polymerization being discovered are leading not only to novel and sometimes unimagined substances, but also to new knowledge of the relations between properties and structures. For example, polymers containing metals in their backbone are already finding applications in rocketry.

A fruitful field of study is that of the nylon-type condensations taking place at the interlayer between two immiscible liquids, *e.g.* an amine in an aqueous layer and an acid chloride in a hydrocarbon layer, the product at the interlayer being drawn out as formed or being produced on stirring. This has led to the discovery of a number of polymers not accessible by normal high-temperature condensation methods.

Several new materials have been obtained through addition reactions, *e.g.* with ethylene oxide or caprolactam. The mere distilling of the monomer can sometimes yield interesting products; thus chelated beryllium compounds give long-chain, high-molecular-weight soluble polymers.

Vinyl polymerization likewise yields products of interest, the processes being initiated by free radicals or anions. Other polymerizations have been effected with boron alkyls at temperatures as low as −60 to −80°C. Much other work has been done on polymerization by means of ultra-violet light and X-rays. Studies of the effects of alkali-metal and other catalysts have also yielded interesting results.

In a short expression of thanks to the lecturers, Professor R. G. W. Norrish, F.R.S., referred particularly to the very wide perspective they had given of the great importance in industry of chemistry of many different kinds, and the various points of view from which scientific results have to be considered in working on the commercial scale.

The Chairman for the afternoon session was Mr D. H. Bell, Chairman, Mid-Southern Counties Section.

Two lectures were delivered. First, Mr A. B. Thompson, of Imperial Chemical Industries Ltd, Fibres Division, spoke on 'Fibres from Polypropylene'—an outstanding example of the pace with which a promising laboratory discovery can become an important factor in large-scale manufacture and in economic planning.

High-molecular-weight products from propylene were reported in 1952 by Fontana *et al.*, who used a $AlBr_3$–HBr catalyst system, but they obtained viscous oils or soft amorphous solids of little apparent technical interest. A modified Ziegler catalyst based on $AlEt_3$ and $TiCl_4$ discovered in 1954 by Natta was found to give steric regularity in the polymer. The product had a higher softening point than polythene, together with lower density and a higher rigidity less sharply reduced with rise in temperature. These properties, and the low cost of manufacture from a readily available monomer, made polypropylene of considerable potential value as a moulding plastic. Already production had risen in the U.S.A. to 60,000 tons (1960) and is expected to reach 250,000 tons (shared among eight major producers) in 1962. The output of the new Wilton plant, designed to produce 11,000 tons a year, is already to be expanded to at least three times this figure in the next few years.

Polypropylene can also be employed for melt-extruded film, monofilament and fibre, and these applications are likewise being developed. The fibres are of low density, high strength and high durability, and in price fall between the more expensive synthetics and finer wools, on the one hand, and rayons, cotton and bast fibres, on the other.

The catalyst—the key to the manufacturing process—is suspended in a suitable inert diluent and highly-purified propylene is passed in. Choice of temperature

and the presence of various additives control the molecular weight of the product (*ca.* 40,000–80,000).

Mr Thompson then considered the various factors influencing the molecular structure and mechanical properties of the fibres, a full account of which will be published in this *Journal* later in the year.

The final paper, on 'The Heavy Organic Chemicals Industry in the U.K.', was presented by Mr H. P. Hodge, of the Chemicals Division, Esso Petroleum Co. Ltd.

Production of heavy organic chemicals in the U.K. increased by 280 per cent over the period 1949–59, equivalent to a growth of 11 per cent per year. This compares with an average growth rate over the same period of 7 per cent for all chemicals, 37 per cent for petroleum chemicals, 15 per cent for plastics, 6 per cent for motor vehicles and 3 per cent for all manufacturing industries.

Much of this growth has therefore arisen from the rapid expansion of the petroleum chemical industry, such that petroleum's share as a raw material for organic chemical production has risen from 9 per cent of the total for 1949 to 47 per cent in 1959, and is forecast to rise to 65 per cent by 1962. This has been accompanied by a decreasing share for the other sources of raw materials, namely coal, acetylene and fermentation.

Capital expenditure by the chemical industry on new plant and equipment in the 10 years 1949–59 amounted to just over £1,000 m. and of this £125 m. went on new petroleum chemical manufacturing plant, which in many cases was erected to produce products not previously manufactured in Britain. By the end of 1962 investment in petroleum chemical plant will have risen to about £200 m.

Many new plants now operating in the U.K. are producing petroleum chemicals, some of which were not previously produced at all, or only in small experimental quantities 10 years ago. These chemicals are the basis of important types of plastics, synthetic rubber, synthetic detergents, man-made fibres, surface coatings and general chemicals, and production of all these end-products has grown spectacularly with no sign of any slackening in the immediate future.

A large degree of inter-relationship exists between companies in the heavy organic chemicals industry through the operation of joint companies or subsidiaries. Many organizations have assured themselves of their raw material supplies or of outlets for their finished products either by acquisition of suitable companies or through joint operations—and this trend is continuing (*see* H. P. Hodge, 'Petrochemicals in Britain,' *Chem. Engng Prog.*, Feb., 1961, 37–42).

Chemicals represent one of Britain's more important exports, exceeded only by motor vehicles and engineering products. The total value of all chemical exports in 1959 was £290 m., of which organic chemicals accounted for about £70 m. and plastics £40 m. Certain sectors of the organic chemicals industry are now exporting a large proportion of total production, *e.g.* 43 per cent of carbon black production was exported in 1959, 29 per cent of plastics production, 24 per cent of synthetic detergents, 14 per cent of synthetic rubber and 77 per cent of TEL anti-knock fluid. These compare with 10 per cent of production of all manufactured products exported in the same year.

The proceedings were concluded with a vote of thanks by Dr R. W. Bolland (Bristol).

EIGHTY-THIRD ANNUAL GENERAL MEETING

The Eighty-Third Annual General Meeting of the Royal Institute of Chemistry was held in the Assembly Hall of the University of Southampton on Friday, 21 April, 1961, at 9.30 a.m. Mr E. Le Q. Herbert, *President*, was in the Chair, and 205 corporate members signed the record of attendance. The notice convening the Meeting was read by the Secretary.

ORDINARY ANNUAL BUSINESS

1. REPORT OF THE COUNCIL AND REPORT OF THE BENEVOLENT FUND for the Year Ended 30 September, 1960

THE CHAIRMAN called upon the Honorary Treasurer to present the Statements of Account (including those of the Fund for the Development of Education in Chemistry and other special Funds administered by the Institute) and the section of the Annual Report of the Council relating to Finance, House and Staff Matters, together with the Report of the Benevolent Fund.

THE TREASURER (Professor H. Burton) referred first to the Report and Accounts of the Benevolent Fund and said that nothing would induce him to use the word 'satisfactory,' or any other expression that might imply complacency, when speaking of the Fund. During the year under review income from contributions and from other sources had increased appreciably. Expenditure had not risen to the same extent and there had therefore been a substantial balance on the Current Account of the Fund at the end of the period, but this was merely a welcome indication that it might soon be possible to act a little more generously towards those who needed assistance. It must be borne in mind, however, that even a comparatively small increase in the number of calls on the Fund would have turned the balance into a deficit.

Five new requests for help had recently been received, and it seemed likely that substantial assistance would be required in each case. The financial position was not insecure but neither was it particularly reassuring, and the aim of all who were closely associated with the work of the Fund must be to achieve still higher standards and to attract greater support for this worthy cause.

There were no matters in the Report or Accounts of the Benevolent Fund that appeared to call for further explanation, but two important developments had subsequently taken place. It would be recalled that the Rules of the Fund contained a provision limiting investments to Trustee Securities, and that in recent years this Rule had been a serious handicap. The Charity Commissioners had been asked to authorize an alteration that would give greater freedom of investment but they had hitherto taken the view that the Rule could not be amended without the express permission of the High Court. However, as the result of a recent decision in the courts the legal position had been clarified, and the Charity Commissioners had withdrawn their objection to an alteration that would give wider investment powers. The Council had accordingly decided to change the relevant provisions and to seek expert advice on future investment policy. Extensive sales of Trustee Securities would involve a substantial capital loss at the present time as well as a reduction in current income from dividends and interest. A gradual acquisition of equity shares over the coming years would therefore seem to be the wisest course, but no final decision had yet been taken.

As one Rule had to be changed it was intended to revise other Rules relating to administration in order to afford the greater flexibility that was now necessary in view of the growth of the Fund. If, in due course, the proposals for another grade of membership of the Institute were implemented, the desirability of extending the Object of the Fund would also have to be considered. Only present and former Fellows and Associates and their dependants were eligible for assistance at present, but it would seem desirable that all corporate members, whatever the various grades might be called, either now or at some future date, should be eligible to help from the Fund. If in due course an extension of the Object of the Fund was thought to be desirable, such a change might be complicated by a number of legal difficulties that would have to be taken into account in determining its precise form.

However, these were matters for future consideration, and the immediate task was to present the Report and Accounts of the Fund for the year 1959–60. It had been a good year, and the Benevolent Fund Committee had been able to give reasonably adequate help to those in need without having to worry too much about where the money was to be found. The presentation of the Report afforded a welcome opportunity of thanking everyone whose efforts had achieved this result.

In presenting the Financial Statements of the Institute and the relevant section of the Annual Report of the Council, the Honorary Treasurer said he was happy to report that the financial outcome of the year under review had helped to confirm the opinion he had expressed at the previous Annual General Meeting, when he had said that the Institute had successfully weathered a lengthy economic depression and might expect to enjoy a period of comparative calm. Nevertheless, he felt obliged to dispel any over-optimistic impressions that might have arisen by drawing attention to some future commitments that had to be taken into account.

The Current Account of the Fund for the Development of Education in Chemistry had shown a deficit of £2406. Under item 4 of the Agenda further reference would be made to this deficit and to the need for a substantial increase in the annual transfers to the Fund from the general funds of the Institute. It should be emphasized, however, that the Fund was financing activities—many of them of direct benefit to members—that would otherwise have to be paid for out of the ordinary income of the Institute. It was therefore the responsibility of the Institute to see that the Fund had sufficient resources to carry out its duties effectively. If there had been no upper limit on the amount of annual transfers, the sum passed to the Fund would have been about £5,400 instead of £3,000, and the balance on the Institute's Income and Expenditure Account before the allocations to Reserve Accounts would have been correspondingly smaller.

Secondly, some of the Reserve Accounts that should be built up whenever circumstances permitted were by no means adequate in relation to the contingencies they were designed to meet. This was especially true of the provisions that were being made through leasehold redemption policies for the replacement of the Institute's leasehold building at 30 Russell Square. As an additional measure, the Council had therefore decided to transfer annually a minimum sum of £2,000 to a newly established Building Fund. In the year under review, a total of £5,000 had been passed to this Fund. Even if it were possible to transfer sums of this magnitude regularly over a period of years, this might still not be sufficient because a new and much larger building would probably be needed long before the expiry of the existing lease (in the year 2012).

Moreover, costs of many kinds were rising and would probably continue to rise. The Council did not suffer from the delusion that the Institute was doing everything it should do for the benefit of members and the profession of chemistry, but activities cost money—for printing, postage, equipment, overheads and the salaries of the administrative officers and staff, on whom so much depended. It was only right that those who spared no effort in looking after members' interests should themselves be treated properly.

The Honorary Treasurer concluded his remarks by pointing out that it was the paramount duty of a professional body to behave like any prudent individual —to strive to live within its income, to concentrate on the activities that it could carry out most effectively, to avoid wasteful effort and extravagance and to save a little whenever opportunity offered. It was not easy to do any of those things but he hoped members would agree that the Institute had succeeded in doing so for a period of 12 months.

THE CHAIRMAN said that it had been his privilege to serve on the Benevolent Fund Committee for several years under the Chairmanship of Professor Burton and he could bear witness to the care and attention that were brought to bear on all requests for assistance. All members owed a debt of gratitude to Professor Burton for his devotion to the maintenance and operation of the Fund.

In commenting on the Annual Report of the Council for the year ended 30 September, 1960, the Chairman said that Professor Burton, as Honorary Treasurer, had already covered, directly or indirectly, all the activities and services of the Institute, for they all cost money and improvements and extensions in them were reflected in the Accounts. On the other hand, financial statements could not indicate the very great extent to which the Institute benefited from the voluntary help given by so many of its members. At the end of the main section of the Report, reference had been made to the Council's indebtedness to members and friends in various parts of the world who had helped in furthering the interests of the profession, and he wished to reaffirm this expression of grateful thanks. During his presidency he had had the privilege of attending many meetings of Local Sections and he wished to pay a special tribute to the work of their Officers and Committees.

Copies of the Annual Report had been in the hands of members for about a month, and he did not propose to refer in detail to the various matters mentioned therein but proposed to confine his remarks to some of the developments that had taken place since the end of September, 1960.

The most significant of these was the proposal to establish Licentiateship as a new grade of membership. This was not an entirely new idea but it had seemed that in present circumstances it was likely to receive more support than it had in the past. This view had been confirmed by the outcome of discussions that had been held at Local Section and other meetings on suggestions outlined in the Statement issued by the Council in April, 1960. However, before pursuing the matter further the Council had thought it desirable to hold a referendum on a more specific proposal, as set forth in a Memorandum that had been sent to all corporate members, including those in oversea countries. More than 7,000 corporate members had returned voting papers—a record number in any Institute ballot—and 80 per cent of these members had indicated their support for the proposal. The Council had accordingly decided to call a Special General Meeting in London at which resolutions for making the necessary changes in the By-laws would be submitted. The date and time had not yet been settled, but due notice would be given when final arrangements had been made (*see* the more recent note on p. 224).

In order to become effective, these resolutions for changing the By-laws would have to be approved by at least two-thirds of those voting in person or by proxy at a General Meeting or in any subsequent postal vote that might be demanded, and the changes would then need to be allowed, with or without modification, by the Privy Council. There was therefore some way to go before a Licentiate grade could be established but in the meantime the Council, with the advice of its Study Group on Qualifications, was working out details of appropriate additions and amendments to the Regulations for Admission to Membership. It was vitally important to ensure that proper conditions for admission to Licentiate Membership were established from the outset and that candidates admitted under transitional arrangements should be well up to the prescribed standard.

In association with the Ministry of Education and the corresponding Departments in Scotland and Northern Ireland, the Institute had been concerned with important proposals affecting entry to revised courses for National Certificates. In the engineering field arrangements were well advanced for the introduction of the new plan, but much remained to be done in working out the application of the proposals to chemistry and related fields of science. It appeared, however, that these developments were not only consistent with but might also be helpful to the realization of the Institute's own aims in establishing a Licentiateship grade.

Among those who became immediately eligible for admission to Licentiateship there would be considerable numbers of holders of university degrees and equivalent qualifications who have had a period of approved experience in practice, and it was hoped that many of these would be attracted to membership in this new grade. At the same time the Council was equally concerned to attract to Graduate Membership and Associateship a much larger proportion of those with 1st or 2nd class honours degrees in chemistry from universities in Great Britain and Ireland. With this in mind the Council had recently set up an Ad Hoc Committee on Relations with Universities and University Graduates, and an immediate task of this Committee would be to improve the means for making honours graduates and others aware of the conditions of eligibility for the various grades of membership, and the desirability of their becoming members of the Institute.

The introduction of the Institute's Research Diploma had met with an encouraging response, and some candidates were now preparing their theses, the first of which would probably be submitted before the end of 1961. About 35 members were already registered to work for this new award.

Since the end of the period under review there had been considerable activity in the fields of publication and education. The new format of the *Journal* had become established and had been very well received by members. Moreover the hope expressed in the Annual Report that this change would lead to a further increase in revenue from advertisements had been fully realized. The success attending the first incursion into the field of book publication had been such that the *Laboratory Handbook of Toxic Agents*, published in 1960, had already been reprinted. Among publications sponsored by the Fund for the Development of Education in Chemistry, the first three items for the Institute's *Lecture Series* (formerly *Lectures, Monographs and Reports*) had been prepared and would probably be issued in June. Two new 'Monographs for Teachers' were due for publication shortly. The second and greatly extended edition of the *Index of Chemistry Films* had been published and additional filmstrips were in preparation. Among other specifically educational projects the highly successful Symposium on 'The Teaching of Inorganic Chemistry at Pre-University Level,' sponsored by the Liverpool and North-Western Section, had recently been held at the University of Liverpool (*see* p. 217). The next Summer School in Analytical Chemistry would be held for the first time in Manchester in 1962.

A new edition of the *Register of Fellows and Associates* with a supplementary list of Graduate Members was about to be published, and it was hoped that the issue of another intermittent publication, the *Directory of Independent Consultants*, would not be long delayed now that outstanding questions had been settled.

In a tribute to the administrative officers and members of the staff of the Institute the Chairman expressed, on behalf of all members, his appreciation of the valuable advice and guidance from Dr H. J. T. Ellingham on new developments in general; from Mr D. A. Arnold on the Benevolent Fund, questions of professional status and, in conjunction with Mr J. F. Harding, on finance matters; from Dr F. W. Gibbs on scientific and technical questions as well as Local Section affairs, and from Mr D. G. Chisman on educational matters; from Mr L. W. Winder on examinations, the interpretation of regulations and, in association with Mr R. W. Flack, on National Certificates. The development of the *Journal* and other publications in the past year had made members specially indebted to Dr Gibbs for his work as Editor and for his efforts, with Miss H. M. A. Garden, in bringing about a notable expansion in advertisements. This loyal support of the officers and staff had done much to sustain him throughout his term of office.

THE CHAIRMAN then formally proposed:

That the Report of the Council for the year ended 30 September, 1960, including the Statements of Account, be adopted.

The motion was seconded by Dr F. Hartley.

Questions and comments were then invited on matters covered by the Report or arising from observations of the Chairman and the Honorary Treasurer in presenting it.

MR H. WARD said that his only criticism of the Council was that action in seeking greater freedom from restrictions on investment for the Institute and the Benevolent Fund had not been more prompt and effective. Trustee Securities and other 'fixed interest' investments had greatly depreciated in value and were likely to decline still further. If such securities were sold and equity shares purchased any initial loss of capital or interest would soon be restored. He hoped that the Council would have the courage to 'cut its losses' and embark on a more realistic investment policy.

THE HONORARY TREASURER recalled that a resolution giving unrestricted powers in respect of the Institute's investments had been approved at an Annual General Meeting some years ago, but the Privy Council had subsequently insisted that at least 50 per cent of such investments should continue to be held in Trustee Securities. This maximum had been reached and any further purchases of equity shares would therefore be a violation of the By-laws. The restriction on the investments of the Benevolent Fund had only just been removed, and the Council would certainly make substantial changes in existing investments if this course was recommended by expert advisers.

There being no further questions the resolution was put to the Meeting and *carried unanimously*.

II. ELECTION OF OFFICERS, GENERAL MEMBERS OF THE COUNCIL AND CENSORS

At the request of the Chairman THE SECRETARY read the following Report of the Scrutineers:

'We have examined the ballot papers and report as follows:

The total number of ballot papers received was 3,240, of which one was invalid.

The votes were cast as under—

Censors

Ernest LeQuesne Herbert 3,229; Sir Christopher Kelk Ingold 3,229; Sir Harry Jephcott 3,225; Douglas William Kent-Jones 3,225.
Votes for other eligible Fellows 2.

President

Sir William Kershaw Slater 3,233.
Votes for other eligible Fellows 1.

Vice-Presidents

George Dring 3,233; Frank Arnold Robinson 3,230; Ernest James Vaughan 3,232.

Honorary Treasurer

Harold Burton 3,233.

General Members of Council

Frank Hartley 2,522; Eric Charles Wood 2,416; Edward David Hughes 2,313; Richard Maling Barrer 2,305; Ronald Herbert Purcell 2,261; Desmond Gerard O'Sullivan 2,086; George Henry Bottomley 1,836; John Rose 1,599; Everard Peter Hart 1,556; Herbert Harding Armstrong 1,536.

Signed H. G. Smith
A. J. Feuell
Scrutineers

19 April, 1961.'

THE CHAIRMAN accordingly declared elected in their specified capacities:

President: Sir William Kershaw Slater, K.B.E., F.R.S.

Vice-Presidents: Mr George Dring, Dr F. A. Robinson, Mr E. J. Vaughan, C.B.E.

General Members of the Council: Professor R. M. Barrer, F.R.S., Mr G. H. Bottomley, Dr Frank Hartley, Professor E. D. Hughes, F.R.S., Dr D. G. O'Sullivan, Dr R. H. Purcell, C.B., Dr E. C. Wood.

Censors: Mr E. LeQ. Herbert, Sir Christopher Ingold, F.R.S., Sir Harry Jephcott, Dr D. W. Kent-Jones.

A vote of thanks to Dr H. G. Smith and Dr A. J. Feuell for their valuable work as Scrutineers was proposed by the Chairman and *carried by acclamation.*

VOTE OF THANKS TO THE RETIRING OFFICERS AND MEMBERS OF THE COUNCIL

MR D. H. BELL proposed that a vote of thanks should be accorded to the retiring Officers and Members of the Council. He said that all members would wish to be associated with a special tribute to Mr E. LeQ. Herbert, who had carried out a most responsible and arduous task with great distinction and conspicuous success, and could now lay aside the burden of the presidency in the knowledge that it would be placed on the broad shoulders of Sir William Slater. Fortunately for the Institute, Mr Herbert would continue in office as a Vice-President *ex officio.*

Special thanks were also due to Dr C. W. Herd, Professor Charles Kemball and Mr Clifford Paine, the retiring Vice-Presidents. As Chairman of the Publications Committee Dr Herd had been largely responsible for planning the recent developments in the field of publications, Professor Kemball had been closely associated with the very successful Joint Annual Meetings with the Chemical Society in Belfast and Mr Clifford Paine was a representative of the Institute on the Chemical Council.

The retiring members of the Council were: Mr S. J. H. O. Chard, Mr A. N. Edmondson, Dr H. H. Hodgson, Sir Harry Melville, Miss M. Olliver, Mr L. P. Priestley, Mr C. C. Skou and Dr A. J. V. Underwood. They had all given much valuable time and energy to the work of the Institute in many different ways, and it was fitting that an expression of sincere appreciation should be recorded.

MR R. W. WATRIDGE seconded this vote of thanks, which was *carried unanimously and with acclamation.*

THE CHAIRMAN thanked Mr Bell and all those present at the Meeting for this vote of thanks and for the manner in which it had been received. His duties as President had been onerous but also enjoyable, and his feelings were of relief mingled with regret. However, it was with great pleasure and satisfaction that he welcomed the new President, Sir William Slater, and wished him a happy and successful term of office.

SIR WILLIAM SLATER expressed his warm appreciation of the great honour that members had done him and said that, with the help of the Officers and Council, he would try to maintain the high standards set by his predecessor and serve the Institute to the best of his ability.

III. ELECTION OF AUDITORS

DR R. E. PARKER submitted a proposal that Dr D. I. Coomber and Dr K. G. A. Pankhurst be re-elected as Honorary Auditors for the year 1960–61. This motion, having been seconded by Mr P. F. Corbett, was put to the meeting and *carried unanimously.*

THE HONORARY TREASURER proposed that Messrs J. Y. Finlay Robertson & Co., Chartered Accountants, be re-elected as Professional Auditors of the Institute for the year 1960–61 at the established fee of 225 guineas. The motion was seconded by Mr A. J. Turnbull and *carried unanimously.*

A proposal that a vote of thanks be accorded to Dr Coomber and Dr Pankhurst for their services as Honorary Auditors was *approved with acclamation.*

SPECIAL BUSINESS

IV. FUND FOR THE DEVELOPMENT OF EDUCATION IN CHEMISTRY

The motion, as stated in the Agenda, was as follows:—

That this Annual General Meeting of the corporate members of the Institute, in accordance with the provisions of Clause 6 of the Royal Charter, hereby sanctions an increase from £3,000 to £6,000 in the aggregate of sums of money which may from time to time in any period of twelve consecutive calendar months be transferred out of the general funds as a contribution to The Royal Institute of Chemistry Fund for the Development of Education in Chemistry for the purpose of furthering the objects of the said Charity, and that any transfer which may be made pursuant to the Resolution numbered 5

passed at the Annual General Meeting of the Institute held on 5 April, 1957, shall not form part of such aggregate.

THE CHAIRMAN, in formally proposing this motion, said that the need for increased transfers to the Fund had been foreshadowed in the Annual Report of the Council, and a statement commending the motion had been circulated with the Notice of the Meeting.

The Institute, like other professional bodies that enjoyed the privilege of a Royal Charter, accepted wide responsibilities related to the advancement of the profession, and these included the development of education in chemistry. On the other hand, there was no reason why the Institute should not receive help from outside sources and claim certain privileges and tax concessions in respect of this work. It was for this reason that the Fund for the Development of Education in Chemistry had been formed. The Fund was a separate legal entity but a payment to the Fund by the Institute was rather like taking money out of one pocket and putting it into another before spending it. If members agreed that the Institute should seek to fulfil its responsibilities in the educational field they should support this resolution. In doing so they would not be encouraging the Council to spend more money. On the contrary, approval of the motion would ensure that the Institute's resources were used to the best advantage.

The motion was seconded by Dr N. Booth.

DR E. S. STERN said that he supported the proposal unreservedly but he thought that the deficit could easily have been foreseen and that the motion before the Meeting should have been submitted earlier. The work of the Fund would not then have been handicapped.

THE HONORARY TREASURER pointed out that the deficit was on the Current Account of the Fund and applied only to the year 1959–60. The Fund itself still had resources for immediate use amounting to £4,646. Thus, there was no question of the work of the Fund being hampered by lack of resources, and the Council had thought it advisable to draw on existing assets before seeking authority for larger transfers from the Institute.

In the absence of further questions the motion was put to the meeting and was *carried without dissentient.*

No count was demanded and proxy votes were therefore not taken into account, but the Chairman reported that he held 514 directed or discretionary proxies which, in the event of a count, he would have cast in favour of the motion; he also held 9 proxy votes to be cast against the motion. Proxies given to other members were as follows—to be cast for the motion 17; against nil; discretionary 3.

The meeting was then closed.

INORGANIC CHEMISTRY IN NATIONAL CERTIFICATE AND DIPLOMA COURSES

A Conference on this topic, organized by the Institute at the Birmingham College of Advanced Technology on 16 May, was attended by 200 technical college representatives, four H.M. Inspectors and Dr J. W. Jenkins, Chairman, Joint Committee for National Certificates in Metallurgy. Mr J. E. Whitney (Catalin Ltd) exhibited some ionic and covalent models.

Dr P. F. R. Venables, Principal of the College, welcomed the representatives and congratulated the Institute on having arranged the first conference of this kind for teachers.

The morning session, under the Chairmanship of Mr J. Maitland-Edwards, H.M. Staff Inspector for Chemistry, included a paper by Professor R. S. Nyholm, F.R.S., on 'The Modern Approach to Inorganic Chemistry.' Professor Nyholm, who is the Assessor in Inorganic Chemistry for Higher National Certificates and Diplomas in Chemistry, outlined the modern presentation of inorganic chemistry and commended the study of ionization potentials as a logical means of introducing concepts such as electronic configurations, quantum numbers and covalent bonding.

This theme was further developed in the afternoon session by Dr J. Lewis, Assessor in Inorganic Chemistry for Ordinary National Certificates in Chemistry. Dr Lewis referred particularly to the applications of the Born–Haber cycle and recent developments in inorganic stereochemistry. The Chairman during this session was Dr F. Briers, Principal, Norwich City College and a representative of the Association of Teachers in Technical Institutions and the Association of Principals of Technical Institutions on the Joint Committee for National Certificates in Chemistry.

Dr Briers also introduced three technical college representatives who delivered short papers on teaching methods. Mr H. R. Jones, head of the science department, Central College of Further Education, Carlett Park, gave a brief summary of the systematization of descriptive inorganic chemistry using the oxidation number as a unifying concept. Dr A. K. Barnard, of Hatfield Technical College, and Dr M. Williams, of Birmingham College of Advanced Technology, described their methods of teaching practical inorganic chemistry—methods that aim to get away from the conventional 'six radical mixture' and the usual quantitative analyses.

A lively discussion formed the third session (Chairman, Mr D. G. Chisman, R.I.C. Education Officer).

THE TEACHING OF INORGANIC CHEMISTRY AT PRE-UNIVERSITY LEVEL

This title was the subject of a Symposium, organized by the Liverpool and North-Western Section of the Institute and held on 15 April in the Donnan Laboratories of the University of Liverpool. It attracted 330 participants from all parts of the United Kingdom. The response far exceeded the expectations of the organizers, and this is a clear indication of the considerable interest in the task of rethinking our methods of teaching inorganic chemistry in the light of modern knowledge and of concern at the widening gap that exists between the traditional requirements of G.C.E. syllabuses and examiners and inorganic chemistry as it is today. The Section was particularly fortunate in securing, as principal speakers, some of the most distinguished inorganic chemists in this country, and much of the success of the proceedings was due to their infectious enthusiasm for their subject—an enthusiasm that belied the oft-heard complaint that inorganic really does mean lifeless.

After delegates had been welcomed by the Section Chairman, Mr E. Myer, the Chair for the morning session was taken by Professor C. E. H. Bawn, F.R.S., (University of Liverpool) to whom the Section is particularly grateful for permission to use the Donnan Laboratories.

CONCEPTS OF ELEMENTARY INORGANIC CHEMISTRY

Professor C. C. Addison (University of Nottingham) gave the first paper on the Concepts of Elementary Inorganic Chemistry in the Light of Modern Knowledge. Professor Addison, in reviewing the fluctuations in the reputation of inorganic chemistry, revealed that very few university entrants had any taste for the subject and, on questioning, a substantial number of these gave the reason that they had 'covered inorganic chemistry at school.' The charge that inorganic chemistry is a mass of unrelated facts was refuted by Professor Addison who insisted that the Periodic Table in its 'long' form provides the master-pattern for the subject and that the Periodic Table in turn finds its interpretation in the electronic structures of the atoms. The pattern represented by the Periodic Classification could not, however, be appreciated unless the elements were studied as a whole, and Professor Addison strongly supported the proposals for the reform of the chemistry syllabus made by the Science Masters' Association and the Association of Women Science Teachers[1]—a general study of all the elements and a detailed study of any one element chosen from each main group and any two elements from the first transition series. He advocated the consideration of the subdivision of the main K, L, M . . . shells into s, p, d and f sub-shells, since only in this way can the long form of the Periodic Table be appreciated. He then turned to the subject of structure in inorganic chemistry and the great advances in our understanding of the properties of inorganic compounds that have resulted from the application of diffraction and other physical techniques. He emphasized that a knowledge of the geometry of a structure should precede any discussion of electronic structure. The value of such knowledge was exemplified by the complex formulae and behaviour of the phosphates, now well understood in terms of linked PO_4 tetrahedra.

Professor Addison concluded with a thought-provoking expression of doubt as to the utility of the concept of equivalent weight. The relation Atomic Weight = Equivalent Weight × Valency was dismissed as pointless, and the specification of concentrations of solutions in terms of normality was heavily criticized. He mentioned examples of the confusion that can arise once the simpler school laboratory exercises have been left behind, the chief reason being that the equivalent weight of an element or compound is rarely a unique property: it varies with the reaction taking place. Concentrations expressed as molarities were preferable.

Mr E. W. Moore (King's Norton Grammar School), immediate past chairman of the S.M.A. and chairman of the Panel which had drawn up the syllabus report, opened the discussion by dwelling on two major problems which faced the teacher of chemistry today. He drew attention to the dangers of presenting modern theories and concepts in a dogmatic manner and without adequate experimental evidence. In this respect he quoted and attacked a statement made in a recent article in this Journal,[2] namely 'the fact that electrons show both wave and particle characters will be readily accepted if introduced at an early stage in chemistry.' The SMA–AWST proposals, on the contrary, aimed to produce students with a challenging and critical attitude towards theoretical speculations. Their recommendations concerning the study of the elements, referred to by Professor Addison, would, he said, leave chemistry teachers much freedom to choose which elements they took for detailed study. Such freedom of choice, which might be varied from year to year, would be immensely stimulating to both teachers and pupils; but it would give rise to great difficulties unless the design of examination papers was altered to accord with teaching practice.

In view of the great importance of structure in inorganic chemistry and the fact that the determination of interatomic distances, interbond angles and space lattices

requires experimental techniques that remain essentially of postgraduate standard, the committee had invited two firms, Crystal Structures Ltd and Catalin Ltd, to exhibit structural models at the Symposium. In addition, the designers of these models, Dr Nora Wooster and Mr J. E. Whitney, had been invited to speak on this topic. Dr Wooster, referring to the relation between crystal structure and chemical characteristics, drew attention to models such as that of copper sulphate pentahydrate in which the shape of the unit cell corresponded with that of a blue vitriol crystal and in which the different environments of the water molecules could be clearly distinguished. The building of silicates from SiO_4 tetrahedra was also clearly shown in models. Mr Whitney gave a summary of a paper in which he had listed experiments that could be carried out under school conditions to show how the physical properties of crystals (mechanical, thermal and optical) could be correlated with their internal structures.

OXIDATION AND REDUCTION

Dr A. G. Sharpe (University of Cambridge), author of the Institute Monograph on 'Principles of Oxidation and Reduction,'[3] then spoke on the teaching of this topic. Dr Sharpe's main theme was that the study of oxidation–reduction reactions could be made to lead up to what he called 'the big ideas' of chemistry. Thus, at an early stage a reaction such as that represented by

$$CuO + H_2 = Cu + H_2O$$

should be seen as a competition between two elements for oxygen and the idea established that chemical reactivity is essentially relative. Similarly, the observation that A oxidizes B, B oxidizes C but that A fails to oxidize C leads to the important distinction between thermodynamic and kinetic factors and the introduction of the concept of activation energy.

The study of redox reactions can begin with the idea of oxygen transfer and proceed through the concept of change of oxidation state to that of electron transfer. The writing of ionic equations involving electron transfer, such as

$$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$$

can be used to emphasize the importance of pH in many redox reactions. Early ideas on oxidation and reduction can be based on the Electrochemical Series and, in this connection, Dr Sharpe advocated that the series should be extended at an early stage to include the non-metallic elements. The redox potential concept is of great value in introducing the student to the importance of some rigid definitions. These include the definition of a hydrogen electrode and the understanding that the values of standard potentials correspond to the presence of both oxidized and reduced forms at unit activity. In conclusion, Dr Sharpe appealed to teachers to use volumetric exercises in a more imaginative way. Redox titrations are particularly easily adapted to this treatment, and the students can be asked to work out the equation for a reaction or a change of oxidation state instead of the customary calculation of a concentration in grams per litre.

USE OF THE PERIODIC TABLE

The last paper of the morning session was given by Dr J. E. Spice (Winchester College, and formerly a lecturer in the University of Liverpool) who spoke on the use of the Periodic Table in the teaching of inorganic chemistry. He began by referring to the intense interest that had been aroused at Winchester by the recent installation of a large periodic table on which were displayed specimens of almost all of the elements. The fact that a hundred different kinds of atom, all built on the same plan, can differ so widely in their properties and give such diverse materials when they combine together is a fact that should fill anyone with wonder. An intelligent use of the Periodic Table at an early stage is invaluable in producing a sense of the romance of chemistry which all children should be given.

Dr Spice suggested that the right approach to the Periodic Table probably lies somewhere between the extremes of a time-consuming historical treatment and a dogmatic application of the *aufbauprinzip*. It seems necessary and desirable to consider *s*, *p*, *d* and *f* electrons in connection with the long form of the table and, although teachers are often reluctant to state results without experimental justification, a surprising number of the facts of modern atomic theory could be demonstrated with quite simple apparatus if school teachers were a little more adventurous in their approach to lecture demonstrations.

With some kind of relationship between atomic structure and the Periodic Table accepted, the different types of atom (inert gases, transition metals and so on) can then be distinguished. Even a very simple electronic theory of valency then makes it possible for such topics as atomic and ionic size, electronegativity, metals and non-metals and oxidation states to be usefully discussed in terms of their variation from one element to another over the Periodic Table. Concepts such as covalency maxima, diagonal relationships and the inert pair can be used profitably even if they have no particular theoretical foundations. Finally, the Periodic Table is invaluable as a means of introducing nuclear properties.

The open discussion following Dr Spice's contribution centred mainly on the following points :—

(*a*) *The Periodic Table and its place in the Syllabus*

There was general agreement that the long form of the table should be used exclusively (except in historical discussions) and general approval of the proposal that the elements should be considered as a whole. The timing of the introduction of this table caused some

controversy—some speakers felt that its derivation from atomic weights and some detailed knowledge of chemical facts should precede the table (one speaker felt that the teachers might find themselves discussing periodicity in volatility of halides with young pupils who did not appreciate the meaning of the term volatility). Others felt that students should be encouraged to take atomic weights and the Periodic Table for granted at an early stage and consider the historical development of the ideas later. Some teachers reported considerable success when the latter method was adopted with students of technologies who know little or no chemistry, but such students were not studying for external examinations. There was also some discussion on the choice of elements for detailed discussion. Some of the problems that face a chemistry teacher who attempts to keep up to date were evident when a speaker who advocated the abolition of references to the lead chamber process was followed by another who had, a few days earlier, seen a new lead-chamber plant under construction.

(*b*) *The Equivalent Weight and Normality Concepts*

Professor Addison's remarks on this topic provoked a good deal of interest, and the organizers have since received several written contributions. In the main, those teaching in schools favoured the retention of the concept—some for historical reasons and others for reasons of examination customs. The widespread use of equivalents in electrochemistry (conductances, Faraday's Laws and the like) were also pointed out. Some technical college teachers were rather more in favour of the concept of 'molar' solutions. (It may be significant that their students more often take internal examinations or those currently set by Professor Addison and Dr Sharpe.) It is clear that much interest was aroused by this topic, and it is suspected that discussion and arguments are still proceeding in a number of establishments. A related complaint raised referred to the tradition of requiring pupils to give equations for all reactions mentioned in examinations, and a suggestion was made that new-style examinations might include a paper in which candidates might make use of textbooks.

DESIGN OF SYLLABUSES

Professor R. S. Nyholm, F.R.S., of University College London, was Chairman in the afternoon and also delivered the opening address. He began by commending the SMA–AWST syllabus as being very much in accord with the spirit of modern inorganic chemistry, and he hoped that every effort would be made to get it adopted in the schools. This syllabus is, however, but an outline, and much detailed thought has yet to go into its interpretation in modern terms. Professor Nyholm, therefore, discussed the way in which the mental picture of inorganic chemistry today differed from that of classical inorganic chemistry. Whereas, in the past, interest tended to cease after the method of preparation of a compound and its quantitative composition and principal reactions with other substances had been investigated, there are, today, many more fundamental questions to answer. These involve studies which can, broadly, be grouped under the headings of 'structure,' 'thermodynamics' and mechanism of reaction. Under structure there is the need to study such points as molecular complexity, co-ordination numbers, stereochemistry and bond character while with thermodynamics one becomes involved in heat of reaction and equilibrium data.

Professor Nyholm then stressed the importance attaching to the electronic structures of atoms in the interpretation of the nature, structure and stability of chemical compounds and proceeded to demonstrate, with a striking series of slides, the significance of ionization potentials in understanding the patterns of chemical behaviour met with in exploring the Periodic Table. Finally, as if in anticipation of criticism that he was basing chemical arguments on physical concepts which could not be studied in a school, Professor Nyholm gave details of an experiment by which the first ionization potential of argon could be determined with equipment readily available in a school laboratory.

Mr E. H. Coulson (Braintree High School), a member of Council of the Institute and a former chairman of the SMA, then opened a discussion on chemistry syllabuses. He devoted most of his remarks to the problems of working out the details of the SMA–AWST proposals and putting them into practice. A similar project was in progress in the U.S.A.; Mr Coulson, having been in correspondence with its organizers, was able to contrast the scale and progress of the American programme with that of the SMA–AWST. In America a very large sum of money had been made available to the organizers, and highly experienced school and university teachers had been formed into study groups and given full facilities for drawing up detailed proposals and teaching methods. A similar project is urgently required in this country, and it is of the greatest importance that funds should be found and pressure brought to bear on universities and education authorities to release experienced teachers and allow the assembly to meet in peace to discuss the task.

The implementation of the new syllabuses will then require an increased share of the timetable for scientific studies, increased expenditure on laboratories, equipment, technicians and more teachers. The Chancellor of the Exchequer must be awakened to the realities of the situation. Mr Coulson then turned to the problem of examining what had been taught, and asked whether the present examination system was satisfactory. The technical colleges, in association with the Joint Committee of the Royal Institute of Chemistry and the Ministry of Education, already conducted many of their own examinations with adequate safeguarding of

standards by appointed assessors. Would it not be possible for schools to do at least some of their own examining under a similar system? (Mr Coulson is a member of the Joint Committee and Professor Nyholm is senior assessor in inorganic chemistry.) Mr Coulson concluded by saying that the time was ripe for a great advance in chemical education. We had the makings of a good start. In addition to the SMA–AWST proposals the Institute was producing valuable and authoritative material in the form of Monographs for Teachers, film strips and other aids.

Two main themes recurred in the ensuing discussion.

(*a*) *Financing Chemical Education and Inquiries into its Reform*

Suggestions were made that the FBI should be approached and that the various chemical bodies should assist in a project involving research into new methods of teaching, not only by providing financial assistance but by high-level contacts in government circles. The very small expenditure on apparatus and materials and books in grammar schools received considerable criticism. Mr Coulson referred to SMA–AWST reports on this matter,[4] showing that the situation had not improved for some years, and Professor Nyholm referred to a school he recently visited where the chemistry textbooks were old and badly out of date and could not be replaced until they disintegrated. He thought that chemists might do a service in synthesizing poorer binding materials for books! A written contribution to the discussion stated that a large LEA had recently cut its science allocation for sixth-form work from 20*s*. to 15*s*. per capita. The work done by the Industrial Fund in assisting the Public Schools had not been matched, as had been agreed, by government expenditure on state schools.

(*b*) *The New SMA–AWST Syllabus*

After some discussion it became evident that many of those attending were aware of the intentions of the recent joint report but, when a direct question was put, it transpired that hardly any had seen it. The well-laid plans of the organizing committee, whereby each delegate had received a letter drawing attention to the report and a statement that copies would be on sale at the Symposium, had been nullified by the fact that the first printing of the report had already sold out. It seemed that the new chemistry syllabus was not yet being tried out in any school, but that a controlled experiment with the corresponding physics syllabus to 'O' level was being arranged with a group of schools. The question was raised as to what extent schools availed themselves of the current Examining Boards' regulations, which allowed them to submit their own syllabuses, and it was learnt that this was very rarely done.

The final point was made that there is a great shortage of highly qualified teachers of chemistry, and Professor Nyholm remarked that only higher salaries could remedy that situation.

LABORATORY WORK

The second half of the afternoon session was devoted to a discussion of laboratory work in inorganic chemistry, and the first speaker was Professor H. M. N. H. Irving (formerly of the University of Oxford and recently elected to the Chair of Inorganic and Structural Chemistry in the University of Leeds). Professor Irving delivered a stimulating paper, provocative from his opening sentences, when he asked why we should teach practical chemistry at all when it was so time-consuming and costly. He answered his own question by asserting that the purpose of practical work was to give pupils familiarity with chemical substances (including modern materials), to develop their powers of observation and reasoning and to encourage the use of scientific method. This required much more than the conventional volumetric and qualitative analysis, and he added an appeal to teachers to do their utmost to include in their programmes suitable preparative exercises; to convert their analytical exercises, whether qualitative or quantitative, into real problems at all levels; and to introduce, when appropriate, some of the more modern techniques (though there was a tendency for some of these to become 'gimmicks'). He then discussed, in greater detail, the evils of an unthinking approach to qualitative analysis, with its slavish adherence to routine separation tables; in illustration, he referred to his experience as an Institute Examiner. In one Part II examination he had asked candidates to examine qualitatively the product of the reaction between cuprous iodide and sodium hydroxide, and a distressingly large number of candidates had subjected the product to routine group separation, solemnly reporting the absence of silver, lead, mercury and so forth, and, in some cases, that sodium had been detected by flame test but not confirmed.

Professor Irving then discussed the use of small-scale methods and pointed out that their chief value was that they saved a lot of time. This time should not be used to analyse more mixtures but to introduce students to the reactions of many more elements. In this way the chemistry of the rarer elements could be studied.

Turning next to volumetric analysis, Professor Irving then delivered, with the aid of the customary apparatus, a somewhat hilarious but scathing attack on the dreadful techniques practised by many students. He strongly agreed with Professor Addison that analytical chemistry would be well served by the abolition of 'normalities' and called for new types of volumetric exercise which would force the student to think in chemical terms and to tackle stoichiometric calculations from first principles rather than by substituting figures in formulae.

In conclusion he dismissed some of the claims made in favour of classical qualitative analysis as a means of

illustrating the principles of chemical equilibrium and pointed out that the precipitation of metallic sulphides frequently failed to accord with predictions made from solubility-product data. A far better and more interesting way of illustrating the factors affecting equilibrium was to make use of the reagent EDTA (ethylenediamine tetra-acetic acid). Pointing out that EDTA formed complexes with most cations, and using the known values of their stability constants, he carried out a series of experiments with this reagent which delighted his audience.

The discussion was opened by Mr A. C. Cavell (Uppingham School) who stressed that laboratory work, whether preparative or analytical, should be a true investigation. He quoted a number of examples, including the qualitative and quantitative analysis of the product of the action of sulphur dioxide on cupric oxide. He also pointed out that many interesting experimental investigations, too time-consuming for a single pupil, could be most successful when carried out by groups or even whole classes. Such co-operative experiments where, for example, each pupil determined a different point on a graph, had much to commend them. Finally, he suggested that in the later stages of a sixth-form course it is desirable that opportunities should be taken to carry out minor research projects.

The last contribution was made by Dr A. K. Holliday (University of Liverpool) who added a further plea for a reduction in the time devoted to qualitative analysis and recommended a wider range of preparative exercises. In particular, Dr Holliday drew the attention of teachers to the ever-increasing number of volatile inorganic compounds and suggested that these offered a good opportunity of carrying out experiments in non-aqueous conditions and in apparatus a little more adventurous than beakers and flasks. School laboratory facilities were inadequate, and the shortcomings of architects were heavily criticized, especially in connection with fume cupboards. Finally Dr Holliday referred to the criticisms frequently levelled by school teachers against the 'university' requirements in connection with the G.C.E. and pointed out that the university chemistry staffs often had no connection whatever with syllabuses and examinations.

There was little time for a final discussion and it remained for Professor R. A. Morton (University of Liverpool), a Vice-President of the Institute and Chairman of the Institute's Education Committee, to propose a vote of thanks to the speakers and the organizers of the Symposium. He was followed by Mr J. Maitland-Edwards, H.M. Staff Inspector, who added his thanks and those of his colleagues in the Inspectorate who had been present at the meeting.

In addition to exhibits of structural models provided by Crystal Structures Ltd and by Catalin Ltd there was a display of books on inorganic chemistry arranged by Parry's Booksellers of Liverpool. Considerable interest was also shown in the Institute's own publications and all available Monographs for Teachers were sold out and orders placed for many more.

The Symposium Sub-Committee of the Liverpool and North-Western Section had included co-opted members representing the SMA (Mr H. L. Heys) and the AWST (Miss M. Wilson)—a collaboration which it is hoped will continue.

The success of the meeting and the interest shown by teachers have encouraged the Section to consider the sponsorship of a regular series of meetings in the Liverpool Area devoted to various aspects of chemical education.

REFERENCES

1. *Chemistry for Grammar Schools*. SMA–AWST. London: John Murray (Publishers) Ltd. 1961. (2*s*.)
2. E. J. Rothery, 'Suggested Changes in the Chemistry Syllabus,' *J. R. Inst. Chem.*, January, 1961, 2.
3. A. G. Sharpe, *Principles of Oxidation and Reduction*. (R.I.C. Monographs for Teachers, No. 2. 3*s*. 6*d*.)
4. 'Provision and Maintenance of Laboratories in Grammar Schools.' *School Sci. Rev.*, June, 1960, 461.

H. R. J.

The Section records its thanks to Mr H. R. Jones, Honorary Secretary, whose hard work and inspiration contributed greatly to the success of the Symposium, and to the Institute's staff, and in particular to Mr D. G. Chisman, *Education Officer*, for their co-operation in handling the administrative arrangements.

Chemistry Course for Teachers.—The chemistry and biology department of the South-East Essex Technical College, Dagenham, held a four-day refresher course in chemistry attended by 38 teachers just after Easter. The main theme of the course was 'Analytical Methods.' Lecture topics included the theory of sampling, complexometric titrations, ion-exchange resins, coulometric titrations, quantitative organic analysis, chromatography and the history of analytical chemistry. The guest lecture was delivered by Professor R. S. Nyholm, F.R.S., who took as his title 'Metallic Complexes and their uses in Analytical Chemistry'; Mr E. H. Coulson, of Braintree County High School, gave an interesting and helpful lecture on 'Keeping up to Date.' Laboratory classes were held in newer volumetric methods, chromatography, optical methods and semi-micro analysis. Discussions on teaching were also held, and there was an exhibition of apparatus and textbooks provided by manufacturers and publishers. A similar course in biology was held at the same time.

Book Reviews

CRYSTALLIZATION. J. W. Mullin. Pp. ix + 268. *London: Butterworths*, 1961. 60*s*.

Although crystallization has been used as a manufacturing process since the beginning of civilization, it is surprising that no books in the English language have previously been devoted to a general treatment of crystallization practice. This volume is, therefore, welcome as it gives a useful introduction to one of the most widely-used unit operations in the chemical industry.

After a simple introduction to the crystalline state and crystallography, the author reviews the factors affecting the formation of crystals from solutions, and the physical properties of solutions to be considered in investigation of crystallization processes and design of equipment. A simple summary is included of phase equilibria in one-, two-, three- and four-component systems.

The mechanism of crystallization is adequately covered in a chapter surveying nucleation, crystal growth and habit modification. Recent developments in the production of pure products and single crystals are described in a chapter on recrystallization.

An account is given of the ways in which crystallization is effected on the industrial scale. Crystallization equipment used in industry is reviewed and the three main groups—cooling, evaporating and vacuum crystallizers—are described. After this useful summary, factors governing the choice of crystallizers are discussed, and in the final chapter the author deals with all aspects of size grading of crystals.

Useful data summarized in the appendix include a table of solubility products, solubility of inorganic salts in water, heats of solution and heats of fusion. The references included after each chapter will be useful to readers requiring fuller information than can be included in treatises of this nature.

The book should be of particular interest to chemical engineering students. It will also be of value to many chemists and chemical engineers in industry in their preliminary consideration of crystallization problems. The author recommends the publication of more data, particularly applied. This book will have served a useful purpose if it encourages the dissemination of the available knowledge and experience in the process industries.

M. G. T. BURROWS

ON RETRIEVAL SYSTEM THEORY. B. C. Vickery. Pp. x + 159. *London: Butterworths*, 1961. 30*s*.

In this small book the author has made 'an attempt at a unified presentation of the whole problem of information retrieval, treating the subject on general theoretical lines,' and it is my task to gauge how far this aim has been accomplished. The work is a brave attempt to look at a scattered mass of material and to bring rude matter into due form; its success can only be partial on account of the very nature of the subject. In general, the theory of any branch of applied science is preceded by a considerable period of practice; thus the theoretical concepts of fractional distillation or electrical generation are reflections of a prolonged interaction of practice and theory in which, at the beginning, the former predominates, and only in later stages of development does consistent theory emerge and begin to control practice. We are now witnessing the development of a new branch of applied science—and to our surprise, and possibly to the detriment of the subject, we find more theory than practice.

Mr Vickery has given a good overall picture of the published literature of information retrieval, but a newcomer to the subject reading this book could be forgiven for concluding (*a*) that there is no general theory of retrieval and (*b*) that the state of the art is not yet sufficiently developed for it to be of general use, other than through the orthodox channels of original and secondary communications and their indexes. I believe that the inchoateness of the subject as represented in this volume springs from the fact that an applied science derives largely from specific needs; that these needs vary from discipline to discipline in science, and that attempts to find a general solution covering all the disciplines is foredoomed to failure, since these needs are irreconcilable. Thus the information needs of astronomer, chemist and mathematician differ intrinsically and call for a specific approach in each instance. Just as there is no general 'theory of chemical engineering' although there are theories of distillation, crystallization, size reduction and so on, so there is no general 'theory of retrieval' but only a series of differing practices related to differing disciplines.

Nevertheless, in the compass of 150 pages the author has gathered together many of the observations that have been made on this subject and has produced a useful and ordered survey of his material; the book is well written and well produced, and I recommend it cordially to scientists anxious to know how a good many of the workers in this field are thinking.

G. M. DYSON

PROCESS CHARACTERIZATION. H. I. Waterman in collaboration with C. Boelhouwer and D. Th. A. Huibers. Pp. vii + 140. *Amsterdam: Elsevier Publishing Co.; London: D. Van Nostrand Co. Ltd*, 1960. (*Published January* 1961.) 38*s*.

This book is concerned with the graphical analysis of data obtained in the study of technological processes where products are formed by simultaneous and consecutive reactions. The authors advocate that data should be plotted on a right-angled isosceles triangle, with the apex at the right angle representing the starting

material and the two adjacent sides indicating the fraction of desired product and the summed fractions of undesired products. Thus in a typical example (Fig. 27) the pyrolysis of ethane is studied by the use of a graph, with the fraction conversion to ethylene indicated on one side and the summed fractions of coke, hydrogen, methane, C_3 to C_5 hydrocarbons and aromatics along the other. The points obtained by plotting the composition of products formed after different reaction times are shown to lie on a hyperbola. Indeed, it is the thesis of the writers that observations of many kinds can be correlated by the use of suitable hyperbolae. It is readily understandable that if consecutive reactions are studied with time as the variable then the curve will often resemble a hyperbola, but claims are made that changes in other variables also produce results which can be represented by this type of curve. Thus in some instances the compositions of products obtained at different temperatures are said to lie on a hyperbola (for example in the hydrogenation of shale oil, Fig. 9) and the compositions of products obtained with different ratios of reactants (*e.g.* in the synthesis of dodecylbenzenes) are also reported to lie on a hyperbola. Processes examined by this graphical method include hydrogenation, alkylation, isomerization, oxidation, aromatic substitution, halogenation, thermal and catalytic cracking, catalytic refining, hydrodesulphurization and hardening of fatty oils.

The final chapter (25 pp.) discusses the correlation of binary vapour–liquid and ternary liquid equilibrium data. This section of the book recommends the use of empirical equations relating explicitly the mole fraction of one of the components in one phase to the mole fraction of the same component in the other phase.

Any method for the correlation of the results of complex industrial experiments is welcome but, although the subtitle of this work is 'Graphical Statistical Methods of Product Distribution Analysis in Chemical and Physical Operations', statistical methods are not in fact used. The majority of investigators in this country will probably prefer to use the techniques given in 'Design and Analysis of Industrial Experiments,' edited by Owen L. Davies, to arrive at the optimum conditions for their processes rather than employ the methods advocated in this book.

E. F. G. Herington

X-RAY ABSORPTION AND EMISSION IN ANALYTICAL CHEMISTRY. H. A. Liebhafsky, H. G. Pfeiffer, E. H. Winslow and P. D. Zemany. Pp. x + 357. *New York: John Wiley & Sons Inc.; London: John Wiley & Sons Ltd*, 1960. 108*s*.

This book gives a competent and fairly comprehensive account of the application of X-ray absorption and emission to analytical and allied problems. The subject, though not a very modern one, has made great advances in the last two decades owing to a more profound understanding of the potentialities of X-ray spectroscopy and vastly improved instrumentation.

Chapter 1, 'Origin and Properties of X-rays', includes brief but valuable sections on the discovery and generation of X-rays, emission and absorption spectra, X-ray diffraction by crystals and the pioneer work of H. G. J. Moseley. Chapter 2, 'The Measurement of X-ray Intensity', is concerned with a survey of detectors of various kinds and pulse-height selection. The treatment, though condensed, is sufficient for analytical chemists. Chapters 3 and 5 describe absorptiometry with polychromatic and monochromatic beams, respectively, while the intervening chapter 4 deals in a simple manner with X-ray spectra and optics. I feel that this chapter might usefully follow the discussion of detectors in chapter 2 and precede the evaluation of X-ray spectrometers—mainly of American make—in chapter 9. A large number of applications of X-ray absorptiometry are described. The determination of film thicknesses is dealt with in great detail in chapter 6. Chapters 7 and 8 on X-ray emission confirm in a striking manner Moseley's predictions in 1913 about the potential uses of X-ray spectroscopy in the widest sense. Indeed, the authors seem to have been carried away by their enthusiasm in establishing the supremacy of X-ray spectroscopy over its 'optical' equivalent. This battle is by no means over yet, as shown by the latest developments in the field of special light-sources, improved 'Quantometers' and atomic absorption spectroscopy. Chapter 10 gives an adequate though elementary treatment of the use of statistical methods for evaluating the reliability of X-ray spectrometry. The final chapter is devoted to special topics, *viz.* γ-rays, X-ray microscopy, applications of X-ray spectrometry to histochemical analysis and biological problems.

There are seven appendixes containing a wealth of data on characteristic X-ray lines, critical absorption edges, mass absorption coefficients and a valuable bibliography of element determinations. The authors are to be congratulated on the provision of both an author and subject index, on the abundance of notes on actual and potential uses of X-ray spectroscopy and on the high standard of diagrams and illustrations. Analytical chemists should find this book a good source of ideas for new methods in routine and non-routine analysis. The price, although somewhat high for a book of 357 pages, is not unreasonable in view of the high quality of printing and presentation.

J. Rose

PUBLICATIONS RECEIVED

BRITISH STANDARDS

1583 : 1961. Specification for One-mark Pipettes. Pp. 12. 4*s*.

1121 : Part 42 : 1961. Methods for the Analysis of Iron and Steel. Pp. 7. 3*s*.

Institute Affairs

SPECIAL GENERAL MEETING
LICENTIATESHIP GRADE OF MEMBERSHIP

A Special General Meeting of the Institute will be held in the Large Lecture Theatre, The School of Pharmacy, 29–39 Brunswick Square, London, W.C.1, **on Thursday, 20 July, 1961, at 6 p.m.**

The main Resolution submitted will be **to effect such changes in the By-laws of the Institute as will enable a Licentiateship grade of corporate membership to be established** on the basis of the terms and conditions set forth in the Memorandum that was circulated in December, 1960, in connection with a Referendum on the proposal. Subsidiary resolutions will relate to the annual subscription payable by Licentiates and the possible extension of the Object of the Benevolent Fund to cover Licentiates.

Formal notice of the Special General Meeting, with the text of the Resolutions and relevant statements by the Council, will be sent to corporate members in Great Britain and Ireland *under separate cover before the end of June.*

As already reported (*J.*, 103) some 80 per cent of more than 7,000 corporate members who participated in the Referendum indicated their support for the proposal to establish a Licentiateship grade. *But effect cannot be given to this proposal until appropriate changes in the By-laws have been approved by corporate members in General Meeting.* This means that the main Resolution, referred to above, must be approved by a majority of two-thirds of the corporate members voting in person or by proxy at the Special General Meeting. **Members who cannot attend the Meeting are urged to complete and return the proxy form** that will be sent with the formal notice.

BEILBY MEDAL AND PRIZE, 1961

The Administrators of the Sir George Beilby Memorial Fund, representing the Royal Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals, have decided to make awards from the Fund in 1961—each consisting of the newly instituted gold medal with a prize of 100 guineas—to the following:

To CONSTANTIN EDELEANU, M.A., PH.D.—in recognition of his work on the corrosion of metals and alloys, with special reference to the development of the potentiostat technique and its applications to the study of practical problems, and on the characteristics of corrosion reactions in fused salts.

To Professor JACK NUTTING, M.A., B.SC., PH.D., F.I.M.—in recognition of his work in physical metallurgy, especially in the application of the electron microscope to the study of the relationship between microstructure and mechanical properties of metals and alloys and to the investigation of phase changes and dislocation interactions.

Biographical notes on these two medallists will be published in the next issue of the Journal.

In accordance with the revised conditions (*J.*, 1960, 367) the Beilby Medal and Prize will henceforth be offered at intervals of two years, but more than one award may be made on the same occasion, as in this year, if there are several candidates of sufficiently outstanding merit. No further award will therefore be made until 1963.

EXAMINATION, APRIL, 1961

Graduate Membership, Part II

Examiners: Professor W. G. Overend, Dr A. G. Sharpe, Professor W. F. K. Wynne-Jones

Assistant Examiners: Dr D. A. Frye, Dr A. D. Mitchell

The examination was held at the University of London and King's College, Newcastle upon Tyne, the theoretical papers being taken also at various local centres in the periods 10–15 April and 18–21 April, 1961.

The total number of candidates was 163, of whom 61 passed (37·4 per cent).

Of the 163 candidates, one studied full-time and passed; 33 attended 'sandwich' courses (25 passed); 36 attended part-time courses preceded or followed by a period of full-time study (13 passed); 93 trained wholly by means of part-time study (22 passed).

Of the 61 candidates who passed Part II, 47 had either passed Part I or had been exempted from it under the current Regulations (77 per cent).

PASS LIST

ANDERSON, Wilfred de Ferry, Rutherford College of Technology, Newcastle upon Tyne

BAGCHI, Sankar Prosad, Sir John Cass College, London

BAKER, Billie, College of Further Education, Whitehaven

BANFORD, Leonard, Lanchester College of Technology, Coventry

BARBER, Lawrence Edward, B.SC. (LOND.), Harris College, Preston

BARNES, Brian Harold, Chelsea College of Science and Technology, London; Northampton College of Advanced Technology, London

BEAN, John, Medway College of Technology, Chatham

BEASLEY, Edward, Rutherford College of Technology, Newcastle upon Tyne

BRASH, James Hugh, College of Technology, Liverpool

BURRELL, Anthony Eric, College of Technology, Portsmouth

BURROWS, Ronald, A.M.C.T., College of Science and Technology, Manchester; Royal Technical College, Salford

CALDWELL, Derek Stanley, Welsh College of Advanced Technology, Cardiff

CHAMBERS, Michael Robert, Northampton College of Advanced Technology, London; Sir John Cass College, London

CHESTERTON, Kenneth, Technical College, St Helens; Wigan and District Mining and Technical College.
CLAY, William Maxwell, College of Further Education, Widnes
CRESSWELL, Michael Alan, Medway College of Technology, Chatham
DENTON, David Alan, Royal Technical College, Salford
EVANS, Anthony James, Flintshire Technical College, Connah's Quay
FELSTEAD, Peter, Woolwich Polytechnic, London
FLEET, Bernard, Brunel College of Technology, London; College of Further Education, Widnes
FLOOD, Alan Frederick, Rutherford College of Technology, Newcastle upon Tyne
FOSTER, John George, College of Further Education, Whitehaven
GILDERSLEVE, David Roy, Welsh College of Advanced Technology, Cardiff; Medway College of Technology, Chatham
GORE, Geoffrey Ivor, Welsh College of Advanced Technology, Cardiff
GREEN, Brian James, B.SC.(LOND.), Norwood Technical College, London
HALL, Raymond Frederick, Civic College, Ipswich; S.W. Essex Technical College, Walthamstow, London
HARPER, James Stanley, Royal Technical College, Salford
HETHERINGTON, Derek Swinburne, College of Further Education, Whitehaven
HOPE, David, College of Further Education, Whitehaven
HUGHES, Albert Douglas, College of Technology, Liverpool
HYDE, Thomas Gerald, College of Further Education, Whitehaven
KIRK, Ronald Sydney, Battersea College of Technology, London
KNIGHT, Harry, Central College of Further Education, Carlett Park, Eastham (Wirral)
LEATHER, Edward Harry, Technical College, Birkenhead
LEWIS, Eric John, Chelsea College of Science and Technology, London; Northampton College of Advanced Technology, London
LOBECK, Ronald Thomas, Welsh College of Advanced Technology, Cardiff
MACKIE, Anthony Grossart, Technical College, Bolton; Royal Technical College, Salford
MATTHEWS, Bryan John, Medway College of Technology, Chatham
MOORE, Leonard Francis, Derby and District College of Technology, Derby
MORRIS, Anthony Francis John, Northampton College of Advanced Technology, London
PAGE, John Michael, Lanchester College of Technology, Coventry; College of Technology, Northampton
PESKETT, Francis John, College of Technology, Portsmouth
PINNEGAR, Michael Alan, Medway College of Technology, Chatham
PITCHFORD, Peter Geoffrey, Brunel College of Technology, London; College of Further Education, Slough
ROSS, James Simpson, B.SC.(GLAS.), The University, Glasgow; College of Further Education, Whitehaven
ROWE, David Alfred, Constantine Technical College, Middlesbrough
SALVAGE, John Kenneth, Flintshire Technical College, Connah's Quay; Central College of Further Education, Carlett Park, Eastham (Wirral)
SETTLE, Colin, Flintshire Technical College, Connah's Quay
SMALLEY, Graham, College of Technology, Leicester
STARTUP, John William, Chelsea College of Science and Technology, London; Northampton College of Advanced Technology, London
TILLMAN, John Edward William, Medway College of Technology, Chatham
TIPLADY, Arthur, Technical College, Birkenhead; College of Technology, Liverpool
TISSINGTON, Peter, Medway College of Technology, Chatham
TROW, Stanley Arthur, Royal Technical College, Salford
TURNER, Michael Frederick, The Polytechnic, Regent Street, London
TWENTYMAN, Francis, B.SC.(LIV.), The University, Liverpool; College of Technology, Oxford; Royal Technical College, Salford
VAUTIER, John, College of Technology, Portsmouth
WALTON, John, Lanchester College of Technology, Coventry
WEBSTER, Peter, College of Technology, Sheffield
WILSON, William David, Medway College of Technology, Chatham
WOODWARD, Geoffrey Michael, Nottingham and District Technical College, Nottingham

PERSONAL NOTES

Honours and Awards

Dr J. C. Craig, *Fellow*, Professor of Chemistry and Pharmaceutical Chemistry at the University of California, San Francisco Medical Centre, was recently awarded the degree of D.Sc. by the University of Sydney for his work in organic and medicinal chemistry.

Dr G. M. Dyson, *Fellow*, was presented with the Patterson award at Antioch College, Yellow Springs, U.S.A., on 13 May for his work in the field of research into the storage and retrieval of scientific data by computer techniques. The award, in honour of the late Dr Austin M. Patterson, is made every two years; this is the first time it has been given to a non-American.

Dr T. F. Macrae, O.B.E., *Fellow*, research director of Glaxo Laboratories Ltd, will have the honorary degree of LL.D. of the University of Glasgow conferred upon him on Commemoration Day, 21 June.

Mr Cecil Waller, *Fellow*, research manager of Ilford Ltd, received the honorary degree of Doctor of Science, University of Bristol, at a congregation of the University on 6 May.

Societies and Institutions

Dr G. W. Cooke, *Fellow*, head of the chemistry department at Rothamsted Experimental Station, Harpenden, and vice-president of the Fertiliser Society since 1960, has been elected President of the Society.

Mr S. D. Sutton, *Fellow*, of Veedip Ltd, has been re-elected chairman of the British Seamless Rubber and Plastic Manufacturers' Association for 1961-62.

Dr D. E. Wheeler, *Fellow*, managing director of the Wellcome Foundation Ltd, has been re-elected vice-president of the Association of the British Pharmaceutical Industry.

Association of Consulting Scientists.—At the Annual General Meeting held in London recently, the following honorary officers and members of Council were elected: Chairman, Dr M. Barent, *Fellow*; Hon. Treasurer, Dr G. W. Ferguson, *Fellow*; Hon. Secretary, Mr W. H. Stevens, *Fellow*; Members of Council, Drs H. H. Chambers, *Associate*, J. G. Davis, *Fellow*, J. Grant, *Fellow*, and R. F. Milton, *Fellow*, and Mr O. W. Roskill, *Fellow*.

Educational

Mr G. Barclay, *Fellow*, principal lecturer in educational methods, Moray House College of Education, Edinburgh, has been appointed vice-principal of the College as from 1 October.

Dr G. C. Bond, *Fellow*, has been appointed to a senior lectureship in chemistry at the University of Hull from 1 October.

Mr J. M. Clements, *Fellow*, at present head of the science department of Belfast Royal Academy, has been appointed headmaster of Newry Grammar School, as from 1 September.

Dr B. E. Conway, *Fellow*, Professor of Chemistry in the University of Ottawa, will be visiting the Institute of Electrochemistry in Moscow for three months under the scientists' exchange programme of the National Research Council and the Academy of Sciences, Moscow.

Dr R. J. W. Cremlyn, *Associate*, at present lecturer in organic chemistry, Brunel College of Technology, has been appointed senior lecturer in organic chemistry, Hatfield College of Technology, as from 1 September.

Dr J. A. W. Dalziel, *Fellow*, of Imperial College, has been appointed reader in inorganic and analytical chemistry, Chelsea College of Science and Technology, as from September.

Dr G. W. Hastings, *Associate*, has left this country to take up an appointment as senior lecturer in polymer science, University of New South Wales.

Dr D. M. S. Wheeler, *Associate*, has been appointed an Assistant Professor of Chemistry at the University of Nebraska, as from 1 June.

Imperial College.—Professor D. M. Newitt, F.R.S., *Fellow*, Pro-Rector of Imperial College and head of the department of chemical engineering and chemical technology, who retires on 30 September, has been appointed senior research fellow at the College. He will be succeeded as head of the department by Professor A. R. Ubbelohde, F.R.S., *Fellow*, Professor of Thermodynamics.

School of Pharmacy.—Dr W. B. Whalley, *Fellow*, reader in organic chemistry in the University of Liverpool, has been appointed to the University of London Chair of Chemistry, tenable at the School of Pharmacy. He succeeds Professor W. H. Linnell, *Fellow*, who is to retire on 30 September.

Public and Industrial

Mr R. Bennett, *Fellow*, has been appointed consultant to the directors of Potter & Clarke Ltd, in connection with the company's chemical development programme.

Mr R. O. Blench, *Fellow*, of the Birds Eye Division, General Foods Corporation, New York, is now at the Corporation's offices in Geneva.

Mr R. R. Butler, *Fellow*, formerly principal of Liverpool College of Technology, has been appointed director of studies of the British Institute of Management Residential Course of Studies on 'Management Practice' at Wadham College, Oxford, in July.

Mr L. Cooper, *Associate*, has taken up a new appointment as development fermentation supervisor at the Beecham Research Laboratories, Worthing.

Dr W. A. Forster, *Associate*, formerly works chemist, Albright & Wilson (Mfg) Ltd, is now manager of the control laboratory (moulding materials), B.I.P. Chemicals Ltd, Oldbury.

Mr W. F. Gerrard, *Fellow*, has resigned his position as technical manager, Liverpool Borax Co. Ltd (Feedwater Specialists Co. Division), and has been appointed managing director of the Atlantic Water Treatment Co. Ltd.

Dr J. Gillies, *Associate*, of the operating department, Imperial Chemical Industries Ltd, Nobel Division, Glasgow, has been appointed works manager at the Dumfries factory, as from 1 June.

Mr F. Hall, *Associate*, formerly manager of the quality control department, Joseph Crosfield & Sons Ltd, Warrington, is now with the Packaging Advisory Division of Unilever at Unilever House, London.

Mr D. L. C. Jackson, *Fellow*, has been appointed chief chemist, Australian Sisalkraft Co. Pty Ltd, Sydney. He was formerly research controller, Reichhold Chemicals Inc. (Aust.) Pty Ltd, Sydney.

Mr E. D. Kamm, *Fellow*, has relinquished his position as overseas director, Imperial Chemical Industries Ltd,

Fibres Division, on his appointment as development director of the new I.C.I. European Council.

Dr R. A. Khan, *Fellow*, has been nominated by the Government of Pakistan as a member of the Drugs Technical Advisory Board constituted by the Ministry of Health under the Drugs Act, 1940.

Mr R. W. Lerrigo, *Associate*, has left this country for Singapore, where he will be with Shell (Eastern) Ltd, Pulau Bukom.

Mr P. D. Liddiard, *Fellow*, has been appointed managing director of Metals and Alloys (Birmingham) Ltd, and its associate company, Metallurgical Refiners Ltd. He will retain direct responsibility for the technical development of the products and processes of the two companies.

Mr R. D. Mannix, *Associate*, has relinquished his post of research chemist, Lobitos Oilfields Ltd, and taken up a position in the information and editorial section, Unilever Research Laboratory, Port Sunlight.

Mr N. Marsh, *Fellow*, technical director and vice-chairman of Ayrton, Saunders & Co. Ltd, Liverpool, has been elected chairman.

Mr J. O'Neill, *Associate*, has recently been appointed manager of the County Borough of Rotherham Sewage Department.

Mr B. G. Overell, *Associate*, has taken up an appointment as senior biochemist, product research laboratory, County Laboratories Ltd. He was formerly with British Drug Houses Ltd.

Mr A. C. W. Pemberton, *Associate*, formerly general superintendent of technical services at the Fawley factory of Monsanto Chemicals Ltd, has been appointed works manager of Monsanto's Newport factory.

Dr A. Rahman, *Associate*, is now working as a member of the Attached Staff in the Chemistry Division of the AERE, Harwell.

Dr G. D. Rosen, *Fellow*, general manager of International Protein Products Ltd, has been appointed to the board of the company.

Mr P. E. Rousseau, *Associate*, managing director of the South African Coal, Oil and Gas Corporation Ltd (Sasol) has been appointed chairman of the corporation. He will continue as managing director for the time being.

Dr D. F. Rushman, *Fellow*, chief chemist of the Kay group of companies, has been appointed a director of Kay Brothers Ltd, of Stockport, Kay Brothers Plastics Ltd and Kay Brothers (Ireland) Ltd.

Mr A. Salam, *Associate*, has been appointed chief chemist, Caltex Oil (Pakistan) Ltd. He was formerly with the Pakistan Ordnance Factories.

Mr F. Shackleton, *Associate*, has been appointed assistant chemist and assistant inspector for the Ministry of Aviation in connection with the supply of electrical paper and board manufactured by B. S. and W. Whiteley Ltd at Pool Paper Mills.

Mr N. T. Simmons, *Fellow*, has been appointed divisional chief scientist in the South-Western Division of the National Coal Board. He was formerly area chief scientist in the No. 5 (Rhymney) Area of the Division.

Mr H. A. Slade, *Associate*, chief chemist, Detel Products Ltd, has joined the board of directors of the company as a co-opted member.

Mr G. F. Sommerville, *Associate*, manager of the Baronet Works, Warrington, of Laporte Chemicals Ltd, has been appointed a director of the company.

Dr R. C. Tincknell, *Associate*, formerly of Shell de Venezuela, has returned and is now a member of the staff of the Shell International Chemical Co. Ltd.

Mr I. C. Twilley, *Associate*, has been promoted from section leader, molding resins, to acting group leader, polymer research, in the National Aniline Division of the Allied Chemical Corporation, Virginia, U.S.A.

Mr T. Watts, *Associate*, formerly of Colgate-Palmolive Ltd, has joined Process Plant Contractors (Campbell) Ltd, Manchester, as a senior chemical engineer in the design department of the technical division.

Mr B. J. Wiggins, *Associate*, has been appointed assistant service manager, Dearborn Chemical Co. Ltd, Toronto.

Mr J. R. Windass, *Fellow*, who has been acting chief chemist of Weston Research Laboratories, has now been appointed chief chemist.

Mr T. J. Woodthorpe, *Fellow*, works manager, Lederle Laboratories Division, Cyanamid of Great Britain Ltd, has been elected to the board of the company.

AERE, Harwell.—Dr W. Wild, *Associate*, has been appointed head of the chemistry division. Mr A. A. Smales, *Fellow*, has been given the status of a division head and will be directly responsible to the director for the scientific work under his control.

Retirements

Mr P. R. Crerar, *Fellow*, has retired from his position with S. A. Azamon, the subsidiary company of Imperial Chemical Industries Ltd in Spain.

Mr C. J. Eastland, *Fellow*, who was formerly chief pharmaceutical research chemist, Allen & Hanburys Ltd, has returned to England for his retirement after visits to Durban and Sydney in connection with the establishment of new control and research laboratories for subsidiary companies.

Mr W. Johnson, *Associate*, industrial service officer, South Eastern Gas Board, is to retire on 31 October.

Mr W. M. Keightley, *Fellow*, deputy pharmaceutical production manager of the Boots Pure Drug Co.'s Beeston works, Nottingham, has retired after 43 years' service.

Mr C. W. G. Martin, *Fellow*, is to retire from the Shell International Petroleum Co. Ltd at the end of this month after more than 40 years' service.

Mr G. V. Taylor, *Fellow*, works manager at the Newport factory of Monsanto Chemicals Ltd, retired on 1 June.

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Sir Christopher INGOLD, F.R.S.
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Douglas William KENT-JONES

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Part II: W. G. OVEREND, PH.D., D.SC. (BIRM.); A. G. SHARPE, M.A., PH.D. (CANTAB.); W. F. K. WYNNE-JONES, B.SC. (OXON. AND WALES), D.SC. (WALES)

Examiners for Diplomas in Applied Chemistry:

Branch A.—General Analytical Chemistry: R. C. CHIRNSIDE; J. HASLAM, D.SC. (MANC.)
Branch B.—Applied Biochemistry: R. A. MORTON, PH.D., D.SC. (LIV.), F.R.S.
Branch C.—Agricultural Chemistry: To be appointed as required
Branch D.—Clinical Chemistry: E. J. KING, M.A., PH.D. (TORONTO), D.SC. (LOND.); I. D. P. WOOTTON, M.A., M.B., B.CHIR. (CANTAB.), PH.D. (LOND.)
Branch E.—The Chemistry, including Microscopy, of Food, Drugs and Water: T. MCLACHLAN, D.C.M., A.C.G.F.C., M.I.BIOL.; H. E. ARCHER, M.R.C.S. (ENG.), L.R.C.P. (LOND.), F.P.S.
Branch F.—The Chemistry of Water Supplies and the Treatment of Sewage and Trade Effluents: J. G. SHERRATT, B.SC. (MANC.)
Branch G.—Industrial Chemistry: W. PRESTON, M.SC., PH.D. (LOND.), M.I.CHEM.E. Examiners in the special sections of Branch G will be appointed as required

Assistant Examiners: D. A. FRYE, B.SC., PH.D. (LOND.), A.R.C.S., D.I.C.; A. D. MITCHELL, D.SC. (LOND.)

Special Examiners: H. V. A. BRISCOE, M.SC. (DURH.), D.SC. (LOND.), A.R.C.S., D.I.C.; J. R. NICHOLLS, C.B.E., D.SC. (LOND.)

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Denys Irvine COOMBER, B.SC., PH.D.
K. G. A. PANKHURST, PH.D., D.SC.

AUDITORS 1961-62

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Union of Lancashire and Cheshire Institutes: Chemical Trades Advisory Committee and the Chemical Trades Examination Board: Dr L. R. RIDGWAY
City and Guilds of London Institute: Advisory Committees:—
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LONDON, Imperial College	Dr G. J. HILLS, Lecturer in Physical Chemistry
LONDON, King's College	Professor D. H. HEY, F.R.S., Professor and Head of Department of Chemistry
LONDON, Queen Elizabeth College	Professor H. BURTON, Professor of Chemistry
LONDON, Queen Mary College	Dr Cecilie M. FRENCH, Lecturer in Chemistry
LONDON, Royal Holloway College	Dr T. G. BONNER, Lecturer in Chemistry
LONDON, University College	Dr A. G. DAVIES, Lecturer in Chemistry
MANCHESTER, The University	Dr G. N. BURKHARDT, Senior Lecturer in Chemistry, Senior Tutor to the Faculty of Science
MANCHESTER, The College of Science and Technology	Dr G. HOLT, Lecturer in Chemistry
NEWCASTLE UPON TYNE, King's College, University of Durham	Vacancy
NOTTINGHAM, The University	Professor C. C. ADDISON, Professor of Inorganic Chemistry
OXFORD, The University	Dr F. M. BREWER, M.B.E., Reader in Inorganic Chemistry
READING, The University	Dr P. F. HOLT, Lecturer in Chemistry
ST ANDREWS, The University	Mr D. M. G. LLOYD, Lecturer in Chemistry
SHEFFIELD, The University	Professor R. D. HAWORTH, F.R.S., Firth Professor and Head of Department of Chemistry
SOUTHAMPTON, The University	Dr R. E. PARKER, Lecturer in Organic Chemistry
SWANSEA, University College	Dr H. E. HALLAM, Lecturer in Chemistry

LIAISON OFFICERS IN TECHNICAL COLLEGES

Technical Colleges are arranged alphabetically under the Regions of the Advisory Councils for Further Education. The letter on the left of each entry signifies the Local Section in whose area the college is situated (for key, *see* page 235).

Colleges recognized to the level of Part I only of the Graduate Membership Examination are marked with an asterisk

ENGLAND AND WALES

I. LONDON AND HOME COUNTIES

(P)	Brighton Technical College	Dr E. G. COWLEY, Head, Department of Chemistry
(P)	Chatham, Medway College of Technology	Dr C. E. SEAMAN, Head, Department of Science
(P)	*Croydon Technical College	Dr S. R. ROBINSON, Head, Department of Science
(P)	Dagenham, S.E. Essex Technical College	Mr J. RATCLIFFE, Head, Department of Chemistry and Biology
(P)	*Dartford, N.W. Kent College of Technology	Mr J. R. BARR, Head, Department of Science
(P)	*Enfield Technical College	Mr L. C. COSGRAVE, Senior Lecturer in Chemistry
(P)	*Guildford County Technical College	Mr J. C. BEVAN, Senior Lecturer in Chemistry
(P)	Hatfield Technical College	Dr R. F. ROBBINS, Head, Department of Science
(P)	Kingston upon Thames Technical College	Mr N. LINDOP, Head, Department of Chemistry and Biology
(P)	London, Brunel College of Technology (Acton)	Dr J. H. SKELLON, Head, Department of Chemistry
(P)	London, Battersea College of Technology	Dr J. E. SALMON, Head, Department of Chemistry
(P)	London, Borough Polytechnic	Dr F. X. AYLWARD, Head, Department of Chemistry and Food Technology
(P)	London, Chelsea College of Science and Technology	Dr A. M. JAMES, Reader in Chemistry
(P)	London, Northampton College of Advanced Technology	Dr D. J. ALNER, Head, Department of Applied Chemistry
(P)	London, Northern Polytechnic	Dr W. GERRARD, Head, Department of Chemistry
(P)	London, Norwood Technical College	Mr M. A. FILL, Head, Department of Chemistry
(P)	London, The Polytechnic, Regent Street	Mr C. W. HYDE, Head, Department of Chemistry and Biology
(P)	London, Sir John Cass College	Mr D. W. WILSON, Principal Lecturer in Chemistry
(P)	London, S.W. Essex Technical College (Walthamstow)	Dr S. LEWIN, Head, Department of Science
(P)	London, West Ham College of Technology	Dr F. L. ALLEN, Head, Department of Chemistry and Biology
(P)	London, Woolwich Polytechnic	Dr A. I. VOGEL, Head, Department of Chemistry
(P)	Luton College of Technology	Miss N. BOOTHMAN, Head, Department of Science
(P)	Slough College of Further Education	Dr B. W. V. HAWES, Head, Department of Science
(P)	*Southend-on-Sea Municipal College	Mr C. R. BARNES, Head, Department of Science

II. SOUTHERN

(R)	Bournemouth Municipal College of Technology	Dr C. J. COOPER, Head, Department of Science
(Y)	Oxford College of Technology	Mr E. J. H. BIRCH, Senior Lecturer in Chemistry
(R)	Portsmouth College of Technology	Dr J. W. GRIFFIN, Head, Department of Chemistry and Biology
(Y)	*Reading Technical College	Dr A. M. BERYL WHITAKER, Senior Lecturer in Chemistry

III. SOUTH WEST

(D)	Bristol College of Science and Technology	Dr R. W. BOLLAND, Head, Department of Chemistry and Biology
(D)	Gloucester Technical College	Dr R. B. WILLIAMS, Head, Department of Science
(W)	Plymouth and Devonport Technical College	Dr A. B. MEGGY, Head, Department of Chemistry

IV. WEST MIDLANDS

(C)	Birmingham College of Advanced Technology	Dr W. G. S. PARKER, Head, Department of Chemistry
(C)	Coventry, Lanchester College of Technology	Dr M. E. FOSS, Head, Department of Chemistry, Metallurgy and Textiles
(C)	*Smethwick, Chance Technical College	Mr T. W. HAY, Head, Department of Science
(C)	Stoke-on-Trent, N. Staffs. College of Technology	Mr W. K. WILDE, Head, Department of Chemistry and Metallurgy
(C)	Wolverhampton and Staffs. College of Technology	Dr A. G. CATCHPOLE, Head, Department of Applied Science

V. EAST MIDLANDS

(H)	Derby and District College of Technology	Dr C. M. ATKINSON, Head, Department of Chemistry
(H)	Leicester College of Technology and Commerce	Mr L. P. PRIESTLEY, Head of the School of Chemistry
(H)	Loughborough College of Technology	Dr R. F. PHILLIPS, Head, Department of Applied Chemistry
(C)	*Northampton College of Technology	Dr W. SIDDALL, Head, Department of Science
(H)	Nottingham and District Technical College	Mr J. R. ROWLANDS, Head, Department of Science
(M)	*Scunthorpe, N. Lindsey Technical College	Mr G. REDPATH, Head, Department of Science and Metallurgy

VI. EAST ANGLIA

(P)	*Cambridgeshire Technical College	Mr P. S. JEWELL, Head, Department of Science
(P)	*Chelmsford, Mid-Essex Technical College	Dr T. GREEN, Lecturer in Chemistry
(G)	*Ipswich Civic College	Mr H. S. HUNT, Head of the School of Science
(G)	Norwich, City College and Art School	Dr F. RODWELL, Senior Lecturer in Chemistry

VII. YORKSHIRE

(U)	*Barnsley College of Technology	Mr J. WILLIAMS, Head, Department of Science
(N)	Bradford Institute of Technology	Dr R. L. ELLIOTT, Head, Department of Chemistry and Dyeing
(U)	*Chesterfield College of Technology	Dr E. I. CHAPPELL, Head, Department of Chemistry and Metallurgy
(U)	*Doncaster Technical College	Mr W. F. ANDREWS, Head, Department of Science
(L)	*Halifax, The Percival Whitley College of Further Education	Dr L. HEY, Head, Department of Chemistry
(L)	Huddersfield College of Technology	Dr E. TITTENSOR, Head, Department of Chemistry and Dyeing
(M)	Hull College of Technology	Mr L. BALMFORTH, Head, Department of Chemistry and Biology
(N)	Leeds College of Technology	Dr W. R. BURNHAM, Head, Department of Chemistry and Biology
(X)	Middlesbrough, Constantine Technical College	Dr V. MOSS, Head, Department of Science and Metallurgy
(U)	*Rotherham College of Technology	Mr G. ROBINSON, Lecturer in Chemistry
(U)	Sheffield College of Technology	Mr A. B. ANGUS, Senior Lecturer in Chemistry

VIII. NORTH WEST

(O)	Birkenhead Technical College	Mr D. G. COOPER, Head, Department of Science
(SS)	Blackburn Technical College	Mr A. WALTON, Head, Department of Science
(Q)	Bolton Technical College	Dr G. W. WOOD, Head, Department of Science
(SS)	Burnley Municipal College	Mr G. BROUGHTON, Lecturer in Chemistry
(Q)	*Bury Technical College	Mr D. G. CROSSE, Head, Department of Science
(O)	Eastham, Central College of Further Education, Carlett Park	Mr H. R. JONES, Head, Department of Science
(SS)	Lancaster and Morecambe College of Further Education	Mr R. Q. ANDERSON, Head, Department of Science and Technology
(O)	Liverpool College of Technology	Dr K. S. W. SING, Head, Department of Chemistry and Biology
(Q)	*Northwich, Mid-Cheshire Central College of Further Education	Mr D. E. CRAIMER, Head, Department of Chemistry and General Science
(Q)	*Oldham Municipal Technical College	Mr V. BLOOMER, Head, Department of Science
(SS)	Preston, The Harris College	Dr S. SKIDMORE, Head, Department of Chemistry and Biology
(O)	St Helens Technical College	Dr L. W. M. TYRRELL, Head, Department of Science
(Q)	Salford, The Royal College of Advanced Technology	Dr G. R. RAMAGE, Head, Department of Chemistry and Applied Chemistry
(Q)	Stockport College for Further Education	Mr H. H. ARMSTRONG, Head, Department of Science
(O)	Widnes College for Further Education	Mr G. H. BOTTOMLEY, Head, Department of Chemistry
(O)	Wigan and District Mining and Technical College	Dr H. K. DEAN, Head, Department of Chemistry

IX. NORTHERN

(S)	Newcastle, Rutherford College of Technology	Mr L. H. W. HALLETT, Head, Department of Chemistry and Metallurgy
(S)	Sunderland Technical College	Dr E. P. HART, Head, Department of Chemistry and Biology
(EE)	Whitehaven College of Further Education	Mr W. P. THISTLETHWAITE, Head, Department of Chemistry

X. WALES

(E)	Cardiff, Welsh College of Advanced Technology	Mr A. H. HENSON, Head, Department of Chemistry and Biology
(T)	Connah's Quay, Flintshire Technical College	Mr S. MCLINTOCK, Head, Department of Chemistry and Metallurgy
(V)	*Neath Technical College	Mr T. B. WILLIAMS, Lecturer in Chemistry
(E)	Newport and Monmouthshire College of Technology	Mr L. MCGRAGHAN, Head, Department of Science
(V)	Swansea College of Technology	Mr B. A. FOX, Senior Lecturer in Chemistry
(E)	Treforest, Glamorgan College of Technology	Mr L. H. THOMAS, Head, Department of Chemistry and Chemical Engineering
(T)	Wrexham, Denbighshire Technical College	Dr E. W. CLAYDON, Head, Department of Science

SCOTLAND

(A)	Aberdeen, Robert Gordon's Technical College	Dr M. B. WATSON, Head, Department of Chemistry
(K)	*Coatbridge Technical College (Lanarkshire)	Dr J. STARK, Head, Department of Chemistry
(FF)	Dundee Technical College	Dr T. J. MORRISON, Head, Department of Chemistry
(J)	Edinburgh, Heriot-Watt College	Professor F. BELL, Head, Department of Chemistry
(K)	Paisley Technical College	Mr J. S. MCLEAN, Head, Department of Chemistry

NORTHERN IRELAND

(B)	Belfast, College of Technology	Dr D. HAMER, Head, Department of Chemistry and Pharmacy

The Manchester College of Science and Technology and the Royal College of Science and Technology, Glasgow, will continue to have Hon. Representatives, whose names appear in the foregoing list.

HON. SECRETARIES OF LOCAL SECTIONS

(A)	Aberdeen and North of Scotland	P. N. HOBSON, B.SC., PH.D., F.R.I.C., Rowett Research Institute, Bucksburn, Aberdeen
(B)	Belfast and District	I. W. MILLIGAN, B.SC., F.I.C.I., A.R.I.C., 65, Glendale Park, Belfast, 8
(C)	Birmingham and Midlands	J. E. GREGORY, B.SC., PH.D., F.R.I.C., 5, Silvermead Road, Sutton Coldfield
(D)	Bristol and District	J. H. WEBER, B.SC., F.R.I.C., The Imperial Tobacco Co. Ltd, Research Department, Raleigh Road, Bristol, 3
(E)	Cardiff and District	R. C. F. STEPHENS, F.R.I.C., Skelmorlie, Stow Park Circle, Newport, Mon.
(EE)	Cumberland and District	A. NAYLOR, B.SC., PH.D., A.R.I.C., 21, Santon Way, Seascale, Cumberland
(F)	Dublin and District	J. T. O'HERLIHY, B.SC., F.R.I.C., 21, Ballymun Avenue, Ballymun, Dublin
(FF)	Dundee and District	P. H. BROUGHTON, A.R.T.C.S., A.R.I.C., Department of Biochemistry, Maryfield Hospital, Dundee
(G)	East Anglia	R. J. NUNN, B.SC., A.R.I.C., 41, Crofton Road, Ipswich, Suffolk
(H)	East Midlands	R. W. HALE, B.SC., F.R.I.C., Blakeney, Tollerton Lane, Tollerton, Nottingham
(J)	Edinburgh and East of Scotland	K. A. SCOTT, A.R.I.C., Department of Pharmacology, University New Buildings, Teviot Place, Edinburgh, 8
(K)	Glasgow and West of Scotland	W. D. WILLIAMS, B.PHARM., PH.D., F.P.S., A.R.I.C., Department of Pharmacy, Royal College of Science and Technology, George Street, Glasgow, C.1
(L)	Huddersfield	F. W. JARVIS, B.SC., F.R.I.C., 577, Bradford Road, Bradley Bar, Huddersfield
(M)	Hull and District	R. K. CHAPMAN, A.R.I.C., T. J. Smith & Nephew Ltd, Neptune Street, Hull
(N)	Leeds Area	W. A. WIGHTMAN, M.A., F.R.I.C., The University, Leeds, 2
(O)	Liverpool and North-Western	H. R. JONES, B.SC., F.R.I.C., The Central College of Further Education, Carlett Park, Eastham, Wirral
(P)	London	G. C. ACKROYD, B.SC., A.R.I.C., Second Floor, 107, Cheapside, London, E.C.2
(Q)	Manchester and District	R. SHACKLETON, F.R.I.C., Magnesium Elektron Ltd, P.O. Box No. 6, Clifton Junction, Manchester
(R)	Mid-Southern Counties	T. F. MCCOMBIE, F.R.I.C., 50, Springdale Avenue, Broadstone, Dorset
(S)	Newcastle upon Tyne and North-East Coast	H. L. HUTTON, B.SC., F.R.I.C., 26, Long Close Road, Hamsterley Mill Estate, Rowlands Gill, Co. Durham

(SS)	North Lancashire	R. E. WILSON, B.SC., A.R.I.C., 315, Blackpool Road, Preston, Lancs.
(T)	North Wales	S. MCLINTOCK, B.SC., F.R.I.C., Chemistry and Metallurgy Department, Flintshire Technical College, Connah's Quay, Nr Chester
(U)	Sheffield, South Yorkshire and North Midlands	J. D. HOBSON, B.SC., PH.D., A.MET., A.I.M., F.R.I.C., 38, Springfield Avenue, Millhouses, Sheffield, 7
(V)	South Wales	H. E. HALLAM, M.SC., PH.D., A.R.I.C., University College, Singleton Park, Swansea
(W)	South-Western Counties	B. M. DOUGALL, M.SC. AGRIC., F.C.S., A.R.I.C., Chemistry Department, Seale-Hayne Agricultural College, Newton Abbot, Devon
(WW)	Stirlingshire and District	R. W. RAE, A.H.-W.C., A.R.I.C., Nappyfaulds House, By Falkirk, Stirlingshire
(X)	Tees-side	G. H. MANSFIELD, B.SC., PH.D., A.R.I.C., 86, Harlsey Road, Hartburn, Stockton-on-Tees, Co. Durham
(Y)	Thames Valley	A. D. JENKINS, B.SC., PH.D., F.R.I.C., Gillette Industries Ltd, Research Laboratory, 454, Basingstoke Road, Reading, Berks.

Overseas

(OA)	Malaya	K. H. LEE, M.A., M.SC., A.R.I.C., Department of Chemistry, University of Malaya in Kuala Lumpur, Pantai Valley, Kuala Lumpur, Malaya
(OB)	Cape	H. E. KRUMM, F.R.I.C., Sonnenschein, 3, Leeuwendel Crescent, Cape Town, South Africa
(OC)	New Zealand	H. J. WOOD, B.SC., F.R.I.C., Dominion Laboratory, Private Bag, Petone, New Zealand
(OD)	Deccan	S. C. PILLAI, B.A., PH.D., A.I.I.SC., M.INST.S.P., A.R.I.C., Indian Institute of Science, Bangalore, 12, India
(OE)	Madras	N. PITCHANDI, M.SC., A.I.I.SC., A.R.I.C., 5, Valliammal Street, Alagappanagar, Madras, 10, India
(OF)	Western India	T. P. S. RAJAN, M.SC., PH.D., A.R.C.S.T., M.INST.F., M.INST.GAS E., F.R.I.C., The Bombay Gas Co. Ltd, Chinchpokli, Bombay, 12, India
(OG)	Northern India	S. NEELAKANTAN, M.SC., F.R.I.C., Department of Chemistry, University of Delhi, Delhi, 8, India
(OH)	Eastern India	A. B. SEN GUPTA, M.SC., PH.D., F.T.I., F.R.I.C., Indian Jute Mills Association Research Institute, 17, Taratola Road, Calcutta, 27, India
(OJ)	Ceylon	R. O. B. WIJESEKERA, B.SC., PH.D., A.R.I.C., Medical Research Institute, Colombo, 8, Ceylon
(OK)	East Africa	R. F. NAYLOR, B.SC., PH.D., A.R.C.T., D.I.C., F.R.I.C., The Royal College, P.O. Box 30197, Nairobi, Kenya

FORTY-FOURTH CONFERENCE OF LOCAL SECTION HONORARY SECRETARIES

The Forty-fourth Conference was held in the Board Room, Institute of Education Building, University of Southampton, at 10 a.m. on Saturday, 22 April, the Chair being taken by the President, Sir William Slater. Mr E. LeQ. Herbert, *Past President*, Professor Harold Burton (Hon. Treasurer; Chairman, Finance and House and Benevolent Fund Committees), Dr C. W. Herd (Chairman, Publications Committee) and Dr F. A. Robinson (Chairman, Professional Status Committee) were present, and the Administrative Officers were in attendance. The Local Sections were represented by their Hon. Secretaries, except for Cardiff and District (Mr H. K. B. Rout, Chairman, in place of Mr R. C. F. Stephens), Cumberland and District (Dr F. H. Day, Member of Committee, in place of Dr A. Naylor), Dublin and District (Mr E. J. Rothery, Member of Committee, in place of Mr J. T. O'Herlihy), Leeds Area (Dr R. L. Elliott, District Member of Council, in place of Mr W. A. Wightman) and Newcastle upon Tyne and North-East Coast (Dr M. A. Hepworth, Hon. Assistant Secretary, in place of Mr H. L. Hutton).

The Sheffield, South Yorkshire and North Midlands Section was unable to send a representative.

Life Membership. The Liverpool and North-Western Section raised the question of how the provisions for life membership might be made more widely known, particularly to members over age 60 to whom the reduced scale of life composition fees might be attractive, especially on their retirement. It was agreed that the point would be met by publishing a notice about these provisions annually, at or about the time subscriptions became due.

Recruitment of Members. The Manchester and District Section asked the Conference to consider the desirability of publishing an information leaflet about the Institute and the advantages of membership, for distribution on suitable occasions, *e.g.* to non-members attending Section meetings. It was reported that a recently constituted Ad Hoc Committee on Relations with Universities and University Graduates would shortly be considering problems of recruitment in the universities, and the views of Local Sections would be welcomed. Information was exchanged as to the methods adopted by certain other societies, and it was agreed that some literature for use as hand-outs was essential. The question was, indeed, now being actively considered.

Service to Educational Establishments. The survey carried out by the Institute and mentioned at the previous Conference (*J.*, 1960, 405) had shown that chemists were in general represented adequately on the advisory committees of technical colleges, but that relatively few grammar schools had any scientists on their governing bodies. From inquiries made at the instance of the

Education Committee it appeared that there was no prospect of dealing with this problem on a national basis, and it therefore remained for the Sections to take up the matter locally. Thus, opportunity might be taken to bring to the notice of the Local Education Officers the names of suitable members who were willing to serve in this way, so that such names would be available when vacancies arose. Since the publication of the *Journal* article (*J.*, 1960, 368) several Sections had received inquiries about these possibilities. But it should be recognized that there is no question of the Institute's being represented: individuals alive to local needs would be taking an interest in educational affairs in their personal capacity.

The representative of the Thames Valley Section expressed pleasure that this matter had received serious attention and hoped that satisfactory results would follow.

British Association Local Branches. The British Association had notified its intention of forming local branches, not only to interest laymen in scientific matters, but also for the purpose of arranging lectures and other events at a level likely to interest scientists. Most of the representatives did not regard this as likely to cut across the activities of the Institute or other specialized scientific bodies, except in so far as it might add to the total number of meetings, which in some areas was already tending to become excessive. It was concluded that, in general, the proposed extension of the British Association's activities would not be disadvantageous, and might in some fields provide opportunities for useful collaboration with local branches of the other scientific bodies, for example, in the organization of lectures for schoolchildren. The Chairman stressed the importance of liaison between Local Sections and the British Association to ensure that undesirable overlap, clashing of dates and so on were avoided, and to enable joint meetings to be arranged on appropriate occasions. On the question of informing the public about scientific advances, there was much to be said for the use of television. The Institute could not take part in this, but there was reason to hope that the British Association would extend this side of its work. To aid future collaboration, it was agreed that the Association should be provided with a list of Hon. Secretaries of Institute Local Sections.

Meetings on Education in Chemistry. The Liverpool and North-Westion Section and the Mid-Southern Counties Section asked for a discussion on the arrangement of meetings devoted to aspects of education in chemistry. It was thought to be particularly important that the existence of the Institute should be brought to the notice of senior schoolchildren and that close collaboration should exist with the Science Masters' Association. Both Sections had, in fact, arranged events in which members of the SMA had taken an active part. At present there was widespread interest in the many problems associated with the teaching of chemistry, and various ways of fostering co-operation and mutual understanding between interested parties were being attempted. Recent examples of successful activities were the Symposia arranged in Liverpool (*see* p. 217) and Dundee (*J.*, 107); the very large attendances at these meetings showed that the need for close co-operation between schools, technical colleges and universities was being widely realized. It was also suggested that the Institute might help Local Education Authorities in organizing more courses for teachers. Among other things, particular attention should be given to the balance of the school syllabus and to the work of various organizations in this field (*see* p. 219). Assuming that a measure of agreement could be reached on what changes were desirable, it would then be necessary to convince the Examinations Boards that the preparation of candidates for the present type of examination papers would largely nullify the progress being made towards devising syllabuses more suitable to modern conditions.

The Institute would like to see representations on these questions made at a high level and it was hoped ways would be found of doing so.

Visiting Lecturers. The Manchester and District Section asked whether the Institute, either alone or in conjunction with other societies, could arrange tours by lecturers from overseas. Apart from the difficulties of financing such operations, it had been found in the past that it was well-nigh impossible to arrange a satisfactory series of lectures that suited the convenience of members in various localities and at the same time did not conflict with the lecturer's own time-table and arrangements. In view of such considerations, it was decided not to pursue the matter any further at present, though it was agreed that Sections should use their initiative in securing the services of eminent scientists from overseas who were known in advance to be visiting their areas.

The Institute office would assist by passing on any information about forthcoming visitors who appeared likely to be able to offer lectures.

At the conclusion of the Conference, Mr T. F. McCombie, Mid-Southern Counties Section, expressed the gratitude of the Sections to the retiring President, Mr E. LeQ. Herbert, for his live sense of the value of the work being done throughout the country by the Sections and for the eagerness he had shown to visit as many of them as possible. Mr McCombie also expressed thanks for the help given to the Sections by the Administrative Officers, and particularly on those occasions when a Local Section acted as host for the Annual Conference. Finally, he warmly thanked the new President, Sir William Slater, for taking the Chair at the meeting and for assuring the Sections that the important matters raised would receive careful attention.

Section Activities

Bristol and District

Titrations in Non-aqueous Solvents. On 2 March, at Gloucester Technical College, Mr E. Minshall of the Bristol College of Science and Technology gave a lecture on 'Titrations in Non-aqueous Solvents.' He said that strengths of acids and bases depend not only on the particular structures but also on the nature of the solvent in which they are dissolved. The equation $HX \rightleftharpoons H^+ + X^-$ suggests presence of free protons, whereas in ionic solvents these protons will be solvated. If the solvent does not solvate protons, the acid will not dissociate, and in terms of the Lowry and Brönsted theory would not be defined as an acid.

Weak bases are levelled (that is, they become stronger bases) in protogenic or acidic solvents, the strength depending on the degree of acidity in the solvent. Similarly acids are levelled in protophilic solvents. In water, the best example of an amphiprotic solvent, in which neither acid nor basic properties are strongly marked, acids and bases show a wide range of strengths.

In addition to proton properties, the dielectric constant of the solvent plays an important part. Thus water and acetone, although similar (within a power of 10) as basic solvents, have widely different dielectric constants (78 and 19); thus an acid tends to dissociate (as opposed to ionize) very much less in acetone than water. The dielectric effect will be most marked in those reactions which involve a change in the total number of ions. The formation of ion-pairs can result in the inflection point in the titration curve preceding the true equivalence point, a source of considerable error in quantitative titrations.

For a dielectric constant of 10, the calculated dissociation constant of an uni-univalent ion-pair is $0{\cdot}22 \times 10^{-3}$. For a value of 40, the dissociation constant would be 382×10^{-3}.

The choice of suitable solvent is determined not only by these theoretical considerations but also by solvent properties, availability and price, toxicity and stability.

Actual techniques differ little from aqueous techniques, except as regards exclusion of carbon dioxide from basic systems, moisture from any system, temperature control or correction for the high expansion coefficient of most organic solvents, and fine details of end-point detection.

Many indicators developed specifically for routine titrations are now available commercially. Electrode systems (incorporating suitable electrolyte–solvent bridges) can be used in conjunction with conventional pH meters, so long as it is borne in mind that pH does not have the same significance in non-aqueous solvents. Optical absorption at selected wave-lengths can be used to determine end-points from plots of optical density against volume of titrant added.

Both potentiometric and absorption methods lend themselves readily to differential titrimetry. High-frequency conductimetry is in practice uncommon because of difficulties in constructing suitable oscillators of sufficient stability.

After discussing a selection of specific determinations, the lecturer demonstrated the simplicity of these techniques by estimating pyridine in acetic acid, by titrating with acetous-perchloric acid, and nickel in dimethylglyoxime nickel complex in acetic acid–acetonitrile solvent, in which nickel acetate is the counterpart of nickel hydroxide in water.

British Oil & Cake Mills. A party of members and friends visited the Avonmouth factory of the B.O.C.M. on the evening of 11 May. The company manufactures a very wide range of livestock feedingstuffs, and refines both edible and technical oils on a large tonnage basis. The works manager, Mr Woodwark, first gave a brief outline of the development of the company and of the manufacturing processes, and this was followed by a tour of the works with members of the staff as guides. The process used consists largely of the blending of raw materials, imported directly or purchased in this country, to predetermined formulae based on analytical figures for albuminoids, oil, fibre and so on. Much of the process control is automatic. Oilseeds are crushed hot and the expressed oil refined by removal of colour and odour.

At the conclusion of the visit the party was entertained to a buffet supper, and Mr C. H. Manley thanked the hosts on behalf of the Section for a most instructive and enjoyable evening. Those members who accepted the invitation of Mr W. H. Walker to tour the laboratories after supper were well rewarded.

Cumberland and District

New Horizons in Polymer Science. On 17 March, at the Windscale Club, Seascale, Professor C. E. H. Bawn, C.B.E., F.R.S., gave a lecture on 'New Horizons in Polymer Science.' Professor Bawn began by reminding his audience how rapid had been the expansion of plastics technology since the recognition in the early 1930s that natural polymers, such as cellulose, rubber and starch, consisted of simple organic units linked together into extremely large molecules. Organic chemists rapidly discovered how to produce similar large molecules artificially and, by the early 1950s, had exploited all manner of combinations of organic building units and almost persuaded themselves that they had reached the limit of practical development of the polymerization technique. Then in 1953 a discovery was made which provided almost limitless possibilities for future development.

Professor Bawn proceeded to illustrate some of the new possibilities with reference to the single class of polymers derived from unsaturated hydrocarbons.

Considering a polymer of the type $(CH_2–CHX)_n$ it is seen that every other carbon atom is an asymmetric centre and thus the polymer may occur in a *d* or *l* modification according to the disposition of the X groups. This leads to a newly recognized property of polymers known as their tacticity. With Ziegler-type catalysts, it is now possible to synthesize in high yield a polymer that resembles natural rubber, *cis*-1,4-polyisoprene, in almost every respect. Similar catalysts can also be used to polymerize ethylene at room temperature and atmospheric pressure, and to polymerize propylene—a feat not previously achieved. When all the different classes of commercial polymers are considered, the increased scope for development that these new catalysts provide is seen to be enormous.

Consideration of the steric properties of polymers has led to a qualitative understanding that makes it possible to predict many physical properties of specific stereoisomers.

The lecturer then discussed briefly what is known of the nature of these remarkable catalysts, the precise structure and mechanism of action of which is not yet fully understood. They were discovered, like most great discoveries, accidentally, when one day polyethylene was obtained as the product in an investigation of the reaction between aluminium alkyls and ethylene. The reason for this behaviour was meticulously traced to contamination with a nickel salt, and it was subsequently shown by painstaking investigation that any alkyl of groups I-III metals together with a salt of a transition metal from groups IV-VIII exhibited similar catalytic behaviour. The catalyst probably has a bridged structure in which the transition metal is linked to aluminium through carbon atoms.

Professor Bawn concluded by reminding us that although the chemist was now capable of reproducing one natural polymer constructed from a single organic unit, nature in even the simplest proteins combines together many completely different units each in its proper order and each with its specific steric arrangement. We have thus a long way to go yet in polymerization technology.

Annual General Meeting. After a showing of scientific films, the eleventh A.G.M. of the Section was held in the Windscale Club, Seascale, on 14 April.

The following Officers and Members of Committee were elected for the ensuing year: Chairman, Mr J. S. Nairn; Vice-Chairman, Mr J. H. Tonkin; Hon. Secretary-Treasurer, Dr A. Naylor; Members of Committee, Dr B. H. Walter and Messrs W. Baxter, F. Elliott, R. Powell, W. P. Thistlethwaite and N. Wood.

Mr J. S. Nairn expressed the thanks of the Section to the retiring officers of the Committee, Drs Day and Richardson and Messrs Coles and Riley. He also warmly thanked the Hon. Secretary-Treasurer and other officers for their invaluable work during the session.

East Anglia

On 18 April a meeting was held at the works of J. & J. Colman Ltd, Norwich. On a tour of the works members saw the mustard mill, bottling plant for soft drinks, the fabrication of tins and various packaging operations. They were then welcomed at tea by Mr W. Rowan Hare, Chairman of the company.

After tea the party visited the control laboratories, and finally a short meeting was held at which Section members presented three 10-minute papers and two practical demonstrations. The papers were 'Some Uses of the Markham Still' by Mr C. Macfarlane, 'The Use of the Cathode-Ray Polarograph in the Food Industry' by Mr P. A. Lusher and 'An Examination of the Lockwood Method for Estimating the Fineness of Chocolate' by Messrs A. B. Callis and H. F. Bamford. The practical demonstrations were given by Messrs M. R. Barker and E. P. Underwood.

Mr Bamford was in the Chair. A vote of thanks to the speakers, and also to the staff of J. & J. Colman for their part in organizing the meeting, was given by Mr A. G. Avent.

Glasgow and West of Scotland

Annual General Meeting. The forty-second A.G.M. of the Section was held on 10 March in the Royal College of Science and Technology, Glasgow. The Minutes of the previous Annual General Meeting, the Committee's Report for 1960, and the Financial Statement for the year ending 31 December, 1960, were approved.

The following Officers and Members of Committee were elected: Chairman, Professor P. D. Ritchie; Vice-Chairman, Dr J. Bell; Hon. Treasurer, Dr A. C. Syme; Hon. Secretary, Dr W. D. Williams; Members of Committee, Dr J. D. Easton and Mr W. Anderson. The other Members of Committee are: Professors J. N. Davidson, P. L. Pauson and R. A. Raphael, and Messrs P. Birrell and J. W. Murfin. Dr W. Good was re-elected Hon. Auditor.

Dr W. A. Caldwell, the retiring Chairman, proposed the vote of thanks to the retiring Hon. Secretary and Members of Committee, making a special mention of Dr W. Gibb, who relinquished the office of Hon. Secretary after many years of outstanding service.

After the business meeting an address was given entitled 'Some Thoughts on Research and Development,' in which Dr Caldwell, who is research and development director of Imperial Chemical Industries Ltd, Nobel Division, gave some personal views on various aspects of research and development. Among the themes touched on was the desirability of a certain amount of fundamental work being carried out in industry, and the need to have people skilled in seeing where the results of such work had practical applications. On the more applied side, Dr Caldwell emphasized the need for careful thought before experimental work is

undertaken, and the importance of considering from time to time the profitability of such work if it turns out in accordance with expectations. He then considered the factors which made research workers work —professional interest, the carrot and the stick.

Finally, he reviewed the methods of assessing the worth of research and of determining how much effort should be directed to particular problems. His view was that although this determination should of all things be subject to treatment by scientific methods, it was rather regrettably still somewhat of an art.

The vote of thanks to Dr Caldwell for a stimulating address and also for his distinguished service to the Section over many years was proposed by Professor H. Nicol.

HULL AND DISTRICT

Advances in Infra-red Spectroscopy. On 9 March, in the Organic Lecture Theatre, University of Hull, Dr L. J. Bellamy, of the Ministry of Aviation, Explosives Research and Development Establishment, gave a lecture entitled 'Recent Advances in Infra-red Spectroscopy.'

Dr Bellamy stated that the infra-red spectrophotometer is one of the most powerful tools available to the organic chemist. It can be used in the examination of both small and large molecular structures and, by making accurate measurements of intensities as well as frequencies, a lot of information may be obtained that cannot be determined by any other method. By studying the changes in spectra that take place with relatively minor changes in molecular structure, it is becoming possible to understand the reason for spectra appearing in certain positions, and much work is being done on the correlation of the structure of large molecules with their spectra. Numerous examples were cited and illustrated by the use of slides. Further information could be gained on structures by investigating the change of frequency when changing from one solvent to another.

An outline was given of the use of infra-red spectra in the evaluation of different types of tuberculosis. Further examples were given of investigation of the stereochemical aspects of organic compounds.

The lecture was followed by a lively discussion; Dr G. C. Bond proposed the vote of thanks.

Insects in Biochemical Research. On 13 April, Dr H. Lipke, of the Ross Institute of Tropical Hygiene, gave a lecture on 'Insects as Subjects for Biochemical Research.'

Dr Lipke surveyed work being done to determine what governs the various transformations of insects. It has been demonstrated, with silkworms, that the changes from larva to pupa and then to the adult stage are initiated by the diffusion of a substance from the prothoracic glands. Extremely small quantities of this substance have been prepared, and it has been shown that the changes can be accelerated by injection of the hormone. Dr Lipke emphasized the difficulties of this type of work by saying that only 25 mg of hormone substance was produced from two tons of silkworms. As a result of this work the mechanism of change from one form to another in insects was gradually being understood.

The production of light by fireflies was described from a chemical point of view; the process can now be simulated by laboratory apparatus.

It was also shown that certain insects, such as the mosquito, are very adept at converting chemical into mechanical energy. The mosquito in particular has been investigated, the frequency of wing beat being 12,000 per minute. The initial lead to the investigation came from the discovery that when in flight a mosquito's oxygen consumption increases 200 times.

The use of labelled isotopes in the investigation of biological problems was also mentioned.

Dr Lipke then discussed the mechanism of insecticides, with particular reference to DDT. Information was given on the emergence of resistant strains of flies and mosquitoes, and it was shown that after 30 generations some insects have the ability to produce an enzyme that rapidly converts DDT to a similar but non-toxic compound. In conclusion, he mentioned the general use of insecticides in various parts of the world.

After a discussion, the vote of thanks was given by Dr Ward and seconded by Mr G. Colman Green.

The Annual General Meeting of the Section took place immediately before the lecture.

LEEDS AREA

A meeting of the Section was held on 13 March at the Bradford Institute of Technology. Dr D. McNeil, who presided, welcomed members of the Huddersfield Section, who under our new arrangement were attending meetings of the Section held in Bradford.

Professor G. Porter, F.R.S., gave an excellent lecture on 'Flash Photolysis,' which, it is hoped, will form the subject of an extended contribution to the *Journal* in the near future.

In the ensuing discussion many questions were asked about the mechanism of reactions as revealed by flash photolysis methods. It was pointed out that the photolysis radicals were not necessarily the same as thermal radicals and that the fact that the phenyl radical is not known in flash photolysis does not mean that it does not exist. The technique cannot be applied to the mechanism of heterogeneous catalysis, but an example was given of its use in studying the light-fading of dyes.

Mr G. J. Weston expressed the thanks of the audience for the remarkable account of the nature and applications of this phenomenon which we had all so much enjoyed.

LIVERPOOL AND NORTH-WESTERN

Atomic Nuclei. On 23 March, Dr A. A. Jaffe lectured on 'Structure and Stability of Atomic Nuclei' at a meeting held in the Technical College, St Helens. Mr G. H. Turner, Vice-Chairman of the Section, presided.

Dr Jaffe outlined the historical development of ideas on atomic structure and the discovery of the main elementary particles. He discussed various ideas on the arrangement of protons, neutrons and electrons in the nucleus, and considered in some detail the reasons for concluding that electrons were not present as individual particles in the nucleus. So far as we can tell, neutrons and protons in the nucleus have similar radii, and neutron–neutron, proton–proton and neutron–proton interaction forces appear to be similar.

The lecturer continued by considering the 'liquid-drop' and 'nuclear shell' models for the nucleus. He discussed some of the observed properties such as stability, nuclear fission and magnetic dipole moments in the light of these models. The idea of nuclear shells was developed to show the occurrence of configurations with maximum stability corresponding to the 'magic numbers' of nucleons.

A lively discussion followed, and finally Dr Blackledge proposed the vote of thanks.

Annual General Meeting. The A.G.M. was held on 6 April in the Muspratt Lecture Theatre, Donnan Laboratories, University of Liverpool. The Chair was taken by Mr E. Myer who announced the following Committee nominations for the forthcoming year: Chairman, Mr G. H. Turner; Vice-Chairman, Mr P. Eaglesfield; Hon. Secretary, Mr H. R. Jones; Hon. Assistant Secretary, Mr B. Haynes; and Hon. Recorder, Mr R. R. Appleby. Drs J. P. Riley and K. S. W. Sing and Messrs J. Ashley-Jones and W. Murray retired from the Committee and were replaced by Dr A. Hickling and Messrs A. Byrne, L. Munday and C. B. F. Rice.

The Hon. Treasurer, Mr L. Wild, presented his final report after seven years in this office, from which he now felt obliged to retire; he thanked the Hon. Auditors for their services. Mr G. W. Beaumont had agreed to act as Hon. Treasurer for the forthcoming year, and was accordingly elected to that office; the Hon. Auditors, Messrs L. V. Cocks and P. N. Williams, were re-elected for a further year.

Mr H. R. Jones, presenting his report at the conclusion of his first session as Hon. Secretary, said that in general attendances at meetings had been satisfactory, averaging between 50 and 70; a large number had attended the ladies' evening and nearly 300 registrations had been received for the symposium on 15 April.

The Vice-Chairman proposed a vote of thanks to the retiring Chairman, Hon. Treasurer and Members of Committee for their services to the Section during the past year.

Dr A. D. Scott, seconded by Dr A. Crossley, put forward resolutions calling for a change in by-laws so that Associates should become eligible for service (*a*) as members of the Council and (*b*) as Officers of the Institute.

After a general discussion in which points of view both for and against the resolutions were put forward, Mr P. N. Williams, District Member of Council, summarized the opinions against the resolutions which were held by the Council and by the Section Committee. The first resolution was defeated by 33 votes to 16 and the second by 32 votes to 17.

Colour Photography. The business meeting was followed by a lecture by Dr R. A. Jeffreys, of the research department, Kodak Ltd, who addressed a large audience on 'Principles and Chemistry of Colour Photography.'

The principles of additive and subtractive colour processes were explained with the aid of slides. The lecturer described, with demonstrations, current reversal colour materials in which the three dyes are formed by processing in separate developers containing the colour formers, and also negative–positive materials in which the colour formers are incorporated in the emulsions with consequent simplified processing. Integral masking with coloured colour formers in negative–positive materials was explained.

The chemical characteristics and properties of spectral sensitizers, developers and colour formers, and the reaction mechanism of coupling development were discussed.

The lecture was illustrated by lantern slides and by practical demonstrations of the development processes described, and ended with a display of colour prints and transparencies.

After the lecture, Dr Jeffreys answered a number of questions from the audience, mostly of a photographic rather than a chemical nature, but which, nevertheless, indicated that a lively interest had been aroused by the lecture.

The vote of thanks to Dr Jeffreys and his assistants was proposed from the Chair.

Biosynthesis. The final meeting of the session was held on 27 April at Birkenhead Technical College, when Professor A. J. Birch, F.R.S., addressed an audience on 'Some Aspects of Biosynthesis'; Mr E. Myer was in the Chair.

The lecturer began with a brief historical review of biogenetic theories. Particular importance was attached to Sir Robert Robinson's classical work in 1917 culminating in his elegant syntheses of the tropane alkaloids. Professor Birch then proceeded to show how the head-to-tail linkage of incorporated acetate units had been established by the study of ^{14}C-labelled systems, and the participation of co-enzyme A in such systems. He gave many examples of how the system could be used

to explain the formation of various natural products, particularly phenolic derivatives, and how classical structure determinations may be checked and possibly corrected. The use of ^{14}C-labelled acetate in producing the predicted labelling pattern was strikingly demonstrated in support of the proposed theory of acetate incorporation. The lecturer then proceeded to a brief summary of how mevalonic acid was shown to be the chief intermediate between the acetate units and the final products, and finally he pointed out the important change of accent in this field from that of entirely degradative and synthetic work in the classical style to that of the biogenetic origins of the natural products.

After a short session in which Professor Birch answered questions from the audience, the vote of thanks was proposed by Mr L. Munday.

LONDON

Chemicals from Acetylene. A lecture on 'Chemicals from Acetylene' was delivered at the West Ham College of Technology on 2 March by Dr S. A. Miller.

Acetylene was discovered by E. Davy in 1836 by the action of water on potassium carbide, and the calcium carbide industry developed rapidly after Willson first made sizeable quantities in an electric furnace in 1892. The lecturer briefly traced the development of dissolved acetylene, first for lighting, and then for oxy-acetylene welding and cutting; chemical uses began with the manufacture of acetaldehyde. Calcium carbide is also converted to cyanamide for agricultural fertilizers.

The economics of calcium carbide manufacture depends largely on the cost of electricity, and frequently on hydro-electric power resources. Dr Miller dealt briefly with the chemistry and technology of carbide production over the last 60 years, and gave world-wide production figures, the total of which reached seven million tons annually in 1959, and was still rising.

Data on the equilibrium between acetylene and its elements at high temperatures were presented. The presence of acetylene in the pyrolysis products of hydrocarbons at temperatures over 1,000°C was first observed by Lewis in 1894. Whereas all hydrocarbons are less stable than acetylene above 600°, the low equilibrium concentration of acetylene itself in respect to its elements means that cracking of hydrocarbons to acetylene can only be achieved if heating to 1,000–1,500° is followed by rapid quenching. Various processes which have been developed to achieve this include the Huels flaming arc and other electrical processes, the Sachse and other flame processes and the Wulff regenerative process. Cracked gas contains at most 25 per cent of acetylene, and separation is complex, based on the use of selective solvents. Considerable tonnages of acetylene are now made from hydrocarbons in the U.S.A., Germany, France and Italy, but the total is still only about 15 per cent of the whole of the world's acetylene.

The first large-scale chemical synthesis was the preparation of acetaldehyde developed during the first world war. The classical German process, still in use, gives product purities better than 99 per cent in up to 93 per cent yield. The Japanese Chisso process is a recent variant, giving 98 per cent yield in a simpler plant. Other hydration schemes were described, including the new one in East Germany, which converts ethylene glycol to its acetal which is subsequently hydrolysed, giving acetaldehyde and reproducing the glycol. Other commercial routes to acetaldehyde (from acetylene or butane) were outlined, as well as the uses of this material.

The production of vinyl chloride has risen in 25 years from nothing to perhaps a million tons per annum. Most of it is made by the addition of hydrogen chloride to acetylene using barium (or mercury) chloride as catalyst, with a 10–12 per cent conversion per pass, and 95 per cent yield on recycling the unconverted reactants. Emulsion polymerization with free-radical initiators give a product with a host of end uses; copolymers with vinyl acetate are also made in large quantities. Vinylidene dichloride is made from vinyl chloride, and the new Du Pont production of polyvinyl fluoride was also mentioned. Trichloroethylene as a degreasing solvent, perchloroethylene as a dry-cleaning solvent, and other chlorinated ethanes are derived from acetylene.

Vinyl acetate is obtained from acetylene and acetic acid and polyvinyl acetate is used mainly in emulsion paints. It is also converted into polyvinyl alcohol, polyvinyl formal and polyvinyl butyral. Acrylonitrile and its polymers and copolymers were next dealt with, the routes from acetylene being compared with those from other starting materials. Ammonia–acetylene condensation produces pyridines. Acetylene black is a special grade of carbon produced for the electrical industry. Vinylacetylene is made by dimerization, then conversion to chloroprene and hence to neoprene. Production of this synthetic rubber amounts to some 100,000 tons per annum.

A number of aspects of the important work of Reppe were described, including the preparation of butynediol, butanediol, butadiene, tetrahydrofuran, polypyrrolidone, vinylpyrrolidone (the polymer of which is compatible with blood proteins, and therefore has been used as a blood-plasma extender, but at present is used in the cosmetic, photographic and dyeing industries), the vinylation of alcohols and the preparation of acrylic esters. Other subjects dealt with included alkynols (methylpentynol is the tranquilizer Oblivon), the synthesis of vitamin A, the preparation and reactions of sodium acetylide made from sodamide in liquid ammonia, cyclo-octatetraene, and the comparative reactivity of silver, copper and other metallic acetylides.

The lecture was well illustrated by a variety of lantern slides.

The vote of thanks to Dr Miller was proposed by Dr G. A. Bulmer, Principal of West Ham College of Technology. The Chairman, Mr A. J. Turnbull, thanked the College authorities.

Bile Acids and Alcohols. A joint meeting of the Section and the Students' Chemical Society was held on 8 March at Chelsea College of Science and Technology. The meeting was opened by Mr C. F. List (Chairman of the Students' Society) who welcomed the visitors and vacated the Chair to Dr J. E. Salmon. Dr Salmon introduced Professor G. A. D. Haselwood, who gave a lecture entitled 'The Newer Chemistry of Bile Acids and Alcohols.'

Professor Haselwood limited his talk to studies made since 1950, mainly in his own laboratory, selecting various alcohols and acids by way of illustration. He first presented a concise account of the sources and methods of isolation of such compounds as ranol, cyprinol, myxinol, trihydroxycoprostanic, bitocholic, hyocholic and allocholic acids. The main feature of the lecture was the determination of the structures of these compounds and their inter-relationships. In this, the usefulness of such techniques as chromatography and infra-red spectroscopy was apparent. After a short discussion Dr D. F. Evered proposed a vote of thanks.

Chemistry of Fluorine. A joint meeting was held at Ewell County Technical College with the College Faraday Society on 20 March. Dr Salmon, Vice-Chairman of the Section, introduced Professor R. N. Haszeldine, who lectured on 'The Chemistry of Fluorine.' The lecture was copiously illustrated with slides, and summarized the history of man's knowledge of the compounds of fluorine and of the element itself. Particular attention was paid to the various types of fluorocarbon compound which had been synthesized in recent years, many of which had been found to have useful properties. A chemistry of the fluorocarbon compounds had been built up, analogous to that of the hydrocarbons, but showing significant differences because of the pronounced electronegative character of fluorine, and of the tendency of the fluorocarbons to react via carbanions or free radicals rather than via carbonium ions as in the case of hydrocarbons. Some polymeric fluorocarbons such as PTFE were by now well known and were finding wide industrial uses; search was now going on for other polymers to meet specific property requirements. Ring and chain polymers of fairly high thermal stability had already been prepared; some containing –C–C–N–O– or –C–N–C–N chains showed low-temperature elasticity, inertness and insolubility.

The vote of thanks was proposed by Mr P. D. Green, a member of the College Faraday Society, and Dr Salmon thanked the College authorities for their hospitality.

Platinum Group Metals. On 22 March Mr E. C. Davies, of Johnson Matthey & Co., delivered a lecture on 'The Platinum Group Metals' to a joint meeting of the Institute and the Society of the Chemical Industry, in the Technological Research Station of Spillers Ltd, Cambridge.

The lecturer began by describing the preliminary separation of the South African platinum-containing nickel–copper ores by gravity concentration and by flotation, and smelting the flotation concentrate with lime, coke and sand to give, after bessemerizing, a nickel–copper sulphide matte containing 50 oz of platinum-group metals per ton. Further smelting then gives a top layer containing essentially the sodium and copper sulphides, and a bottom layer of nickel sulphide, which are both separately converted to the corresponding metals and used as anodes in electrolytic refining cells. The residual anode slime contains 5 per cent platinum metals, which is raised to 60 per cent by roasting and extraction with sulphuric acid. Osmium and ruthenium are then isolated by taking advantage of the volatility of their tetroxides from acid and neutral solution respectively, and tetravalent iridium and rhodium are precipitated as their hydroxides. Finally platinum is isolated as $(NH_4)_2PtCl_6$ and the divalent palladium as $Pd(NH_3)_2Cl_2$. Iridium and rhodium chlorides give complex nitrites in solution, in which form they are separated from the precipitate of base-metal hydroxides, separation then being effected by precipitation of $(NH_4)_2IrCl_6$ and by crystallization of $Na_3RhCl_6.12H_2O$. Platinum is eventually obtained pure by crystallization of Na_2PtCl_6 and ignition of the ammonium salt to give the metal sponge.

Platinum sponge can be melted in high-frequency electric furnaces in zircon containers and the ingots forged and rolled down to sheet or drawn down to wire. The other metals (except palladium) are more difficult to work and are used mostly in the form of alloys. Mr Davies went on to describe the uses of this group of metals and its alloys. There are many applications in the glass and steel-making industries: platinum plating of titanium anti-corrosion anodes for shipping is a recent development. The metals are catalysts for many reactions, including the oxidation of ammonia to nitric acid and the conversion of ammonia and methane to HCN. The use in the platforming process in the petroleum industry for the production of high-octane fuels has accounted for the use of a million ounces of platinum during the decade 1950–1960, leading to a very considerable increase in the total world usage of platinum.

Many questions were asked, covering all aspects of the topic. The lecturer particularly stressed the toxic nature of hexachloroplatinates, which give rise to asthma and dermatitis, and of osmium tetroxide.

Dr J. Williams was Chairman for the evening, and the vote of thanks was proposed by Mr E. G. Peppiatt, Chairman of the London Section of the Society of the Chemical Industry.

Isotopes in Industry. The annual joint meeting with the South Eastern Branch of the Institute of Petroleum was held at the Sun Hotel, Chatham, on 6 April. Mr J. R. Barr, Vice-Chairman of the Kent Sub-Section, welcomed members of the Institute of Petroleum and other guests and introduced the speaker, Mr W. G. Busbridge.

Mr Busbridge first referred to the fact that isotopes were a new tool which had been available for only 12 years, but they were finding ever-increasing fields of application. At present, the British output was used mainly in medicine (50 per cent), research and teaching (30 per cent) and only 20 per cent in industry.

After referring to the increasing availability of isotopes produced by neutron irradiation in nuclear reactions, the lecturer explained the nature of radioactivity and the different types of radiation. Emphasis was laid on the most important aspect of isotopes, namely sensitivity of detection, and hence their usefulness in tracer techniques, in which field they were supreme. The importance of choosing an isotope with an appropriate half-life was also emphasized. For tracer techniques, a low half-life was preferable so that the activity has virtually decayed completely by the time the product reaches the consumer. For continuous measurements, a longer half-life is preferable.

Examples of the use of isotopes in industry were then cited. The measurement of gas and liquid flow rates, once an expensive and tedious process, could now be carried out cheaply with an accuracy of 0·1 per cent. Tracer techniques are used in studying the mixing of chemicals, slurries and foodstuffs and in the movement of silt in estuaries. By choosing an emitter of appropriate type (β or γ) and energy, the thickness of materials ranging from tissue paper to 8 in steel plate could be estimated with an accuracy of 1 per cent. The use of radiation to detect empty or partially-filled containers was also described. This is finding increasing application where mass-production techniques are used.

The replacement of conventional X-ray sets by high-energy γ-emitters in the testing of welds, forgings and castings was referred to. This is particularly advantageous where portability is required, for example, on building sites and in marine engineering, where the conventional X-ray equipment is unsuitable for underwater work.

The sterilization of antibiotics, hospital bedding and medical equipment, such as catheters and hypodermic syringes, by irradiation from a γ-source of high activity had been found to be much cheaper and far more efficient than conventional methods involving heat treatment. Much work is being done in the Research Laboratories at AERE, Wantage, on these and similar applications, such as the disinfestation of grain and sterilization of foodstuffs.

After showing the film 'Radioisotopes in Industry,' Mr Busbridge answered questions put by several members of the audience, emphasizing that provided reasonable precautions were observed, the danger in using radioisotopes was far less than that involved in many other industrial hazards.

The vote of thanks was proposed by Mr J. K. L. Morgan, Hon. Secretary of the South Eastern Branch of the Institute of Petroleum.

Visit to Marks & Spencer Ltd. On 13 April members of the Section visited the technological department of Marks & Spencer Ltd, where they were welcomed by Mr J. N. Robson. The company are specialists in retailing, and not manufacturers; as such their technologists are experts in deciding what the public want and they act as liaison between the public and manufacturers. Their work is carried out largely in the field, *i.e.* in the stores all over the country where goods are being sold and in the works where these are being made; this principle is applied over the whole range of products. Suppliers now welcome the assistance and supervision provided by the Marks & Spencer technological staff. Their task is to draw up specifications for a satisfactory product and ensure that these are adhered to. By this means a continuous picture of quality is transmitted from the stores back to the suppliers, and this system has proved itself to be far more reliable than any form of sampling, with inspection and testing at a central point. Central laboratories are therefore concerned with evaluation of prototypes and such trouble-shooting as may be necessary; no general routine examinations are carried out there.

The tour was begun with a visit to the experimental bakery, where Mr Gelderd displayed and described the production of prototype cakes and other bakery products. This would be followed by drawing up the recipes and specifications, which would then be discussed with the suppliers. Among current investigations are a search for ways of handling coconut to ensure bacteriological sterility; this is not confined merely to finding suitable methods of sterilization, but is being followed at source in Ceylon.

The main chemical laboratory acts as a service for the whole organization, and among the work seen in progress was some on new biscuit mixes and the behaviour of packaging materials. The chemical examination of textiles is also carried out here, and work on improved methods of packaging fruit. The organization insists on the highest standards of hygiene. The laboratory is of impressive design, all benches being topped with armour-plate glass which, it is claimed, has actually reduced the incidence of breakages. Gas heating has been entirely eliminated, and electric 'Bunsen Burners' are much in evidence.

The party was divided into three for a tour of the textile laboratories, which are in three sections. Mechanical testing is carried out in an air-conditioned laboratory where the behaviour of blended fabrics is

being studied, particularly for resistance to 'pilling.' In the general textile laboratory samples are prepared and a wide variety of miscellaneous testing is carried out, including tests on light-fastness, behaviour of buttons and fasteners, ageing and other life tests. The wet-processing laboratory reproduces laundering and cleaning processes. Standard laundry test equipment is employed and most systems of home washing and cleaning can also be simulated. Tests on fabrics themselves are apt to be misleading, for all finished garments are composite in character if only to a small degree, *e.g.* by the stitching thread employed. Testing is therefore concentrated on finished garments, with close attention to variation in shrinkage and the compatability or otherwise of different fabrics.

In the colour room Mr I. Glasman outlined the principles of colour selection. These had to satisfy the customer not only in respect of the single garment purchased but to provide a blend with others which may be worn at the same time. An additional and most important requirement in an organization where all goods were on open display was that the whole range of colours available should themselves present a pleasant picture when displayed together. The colour room is lighted to simulate a store, with natural daylight as an alternative; there are also colour-matching cabinets for specific conditions where some of the unhappy effects that can result from incorrect selection of dyestuffs were demonstrated.

The tour was concluded in the food exhibition, with Mr A. E. Wright as guide. This exhibition illustrates conditions under which goods are manufactured, the dating methods for food products of low shelf-life and the recent developments in grading of fruit to ensure optimum condition for sale. Much attention has been given to the marketing of fruit, and the systems employed for apples, pears, tomatoes and bananas were clearly illustrated.

Finally Mr N. Goldenberg, technical executive, food group, joined the visitors for tea and discussion; Mr P. A. Raine expressed the thanks of the party for a most interesting afternoon.

Gem Stones and Jewels. The Annual Ladies Evening was held at the Royal Institution on 24 April, when Mr R. C. Chirnside lectured on 'Gem Stones and Jewels, Natural and Synthetic.' Mr Raine presided.

The lecturer began with some general observations on gems and jewels. The term gems refers to stones used for adornment, of which only a few are known as precious stones, *e.g.* diamonds, emeralds, rubies and sapphires. In addition there are many beautiful stones in the 'semi-precious' class—amethyst, garnet, topaz, marcasite and so on. Many stones are of industrial importance, through their physical properties, such as hardness and optical and electrical behaviour; a number of them have been made synthetically in the laboratory. Many synthetic crystals are more perfect than the natural stones and of standard quality.

The chemistry of gems and jewels is relatively simple, as most of the stones consist of single, very simple compounds, and Mr Chirnside reviewed the various classes. Silica is the basis of many of the common gemstones, *e.g.* quartz in various forms. Rock crystal is colourless, and the colour of the beautiful silica gemstones, such as rose quartz, amethyst and cairngorm, is due to traces of impurities.

The stimulus to produce synthetic clear quartz crystal came from industrial rather than gem interest. Industrial applications depend on optical properties and responsiveness to pressure in apparatus for control of electrical oscillation frequency; during the war it was necessary to have an alternative source of supply to the natural crystal of Brazil, the only major deposit in the world.

The lecturer described the hydrothermal method of production of large crystals, by solution of quartz or even flints in a solution of sodium metasilicate or sodium carbonate in a steel bomb at about 300°C, and growth on to a seed quartz crystal.

Synthetic emeralds have been produced commercially, probably by a hydrothermal process, in America. These are beryls, beryllium aluminium silicates, with a trace of chromium, and have some of the imperfections of the natural stones.

Another basic process for crystal production is the flame-fusion process, and this was described with particular reference to the second main chemical class of stones, these consisting basically of alumina. The principal stones are white sapphire and ruby, used mainly for bearings in instruments and watches because of their very high hardness—9 on the Moh scale (diamond 10).

The principle of the process is that very pure free-flowing alumina is fed through an oxy-hydrogen blow-pipe flame; the drops fall on to a collecting rod, solidify and gradually build up a boule or a rod consisting of a single crystal of alumina. This is subsequently cut up to form 'V' jewel blanks. The actual process was shown in a film. Rubies are made similarly by adding chromium to give the colour, and it is also possible to make blue sapphires and star rubies and sapphires resembling the natural gems. Synthetic rubies are used for watch-bearings, and a recent application is in the MASER, where the magnetic properties at very low temperatures allow its use in noiseless amplification.

The spinels are also of alumina base, being typically magnesium aluminate. These crystals are of the cubic system, as compared with the hexagonal crystals of sapphire and ruby; the Black Prince Ruby in the British Regalia is in fact a spinel.

Two synthetics based on titanium oxide are made by flame fusion in the U.S.A., these being unique in that they are made for gems and have no counterpart in

nature. They are rutile gem (basically TiO_2) and 'Fabulite' ($SrO{\cdot}TiO_2$) and both are very beautiful, having a higher refractive index, much higher dispersion and therefore greater 'fire' than the diamond. Natural rutile is slightly deficient in oxygen compared with the formula TiO_2, and fusion in an oxidizing atmosphere adds on oxygen and produces the new crystal. Both these stones are a little less hard than the sapphire.

Finally, diamonds are made synthetically for industrial uses, such as diamond drilling, and other purposes requiring hardness. The lecturer gave a short historical survey of the production of synthetic diamonds. In 1954 the General Electric Company of America was successful in producing small diamonds. The process depended on the application of a combination of very high temperatures and pressures—5,000°F and 1,500,000 p.s.i. De Beers and A.S.E.A. of Sweden have also succeeded in making diamonds, and by use of suitable catalysts, such as Cr, Mn, Co, Ni and Ta, and growth across a fine film, temperatures of 2,400°F and pressures of 800,000 p.s.i. can be used. All these synthetic diamonds are very small stones.

This new technique of combined high temperature and pressure has opened up a new field of research into the changes of properties of materials when converted to very dense forms.

The lecture was illustrated by many colour slides and a spectacular demonstration in the darkened hall of burning a diamond in liquid air in a glass vessel.

An exhibition, consisting of a wide range of natural and synthetic stones, including cut and uncut diamonds, was much admired, and the lecturer acknowledged the help of De Beers, the N.P.L., the Diamond and Precious Stones Testing Laboratory and the Royal Institution in this and the demonstrations.

There was a lively discussion, questions ranging from the chemical and physical properties of stones to the price of synthetic diamonds.

The vote of thanks to the lecturer was proposed by Mrs P. A. Raine.

MANCHESTER AND DISTRICT

Protection for the Housewife. On 3 May the Annual Ladies' Evening was held at the Manchester College of Science and Technology. Miss Phyllis Garbutt, principal of the Good Housekeeping Institute, spoke to a large audience of members and their wives. In introducing the speaker, Professor R. N. Haszeldine pointed out that Miss Garbutt was an Associate of the Institute, and that her scientific work had been the basis of a career which had led her to her present position as director of the Good Housekeeping Institute. At the same time she served on a large number of committees which were concerned with the interests of the housewife.

Miss Garbutt explained that as a direct result of the work of chemists the housewife had to choose merchandise which could not be easily judged on sight. Chemists had made rayon look like silk, and were now supplying an almost inexhaustible list of new fibres and plastics. The housewife could not possibly have the necessary technical facilities at her disposal, and so it was natural that various bodies should be set up to evaluate these products. Many of these bodies look after particular aspects, such as safety. Miss Garbutt

Left to right: Professor and Mrs R. N. Haszeldine and Miss Phyllis Garbutt

went on to describe in some detail a number of these organizations and their particular interests. Each body issued a seal for articles which fulfilled their particular requirements. These seals were displayed and their specific meanings described. For instance, the well-known kite mark of the British Electrical Approvals Board indicated a standard of safety, and was not a judgment on the relative usefulness of the appliance. The Good Housekeeping Institute judged an article from all aspects, paying due regard to safety, price and

whether or not it carried out the function for which it was intended. In describing the work of the Good Housekeeping Institute, Miss Garbutt was able to give many examples of great interest, a few more amusing

than serious. Finally she described how housewives get information from the Good Housekeeping Institute, and also the advantages of purchasing goods bearing the seal of that Institute.

At the end of her talk the lecturer answered a number of questions. Mrs Haszeldine expressed the thanks of the audience to the lecturer.

An exhibition showing the tests carried out by the Good Housekeeping Institute had been arranged, and members of that Institute were available to answer the many questions put to them.

MID-SOUTHERN COUNTIES

Recent Developments in Delrin. A joint lecture with the Southern Section of the Plastics Institute and the London Section of the Society of Chemical Industry was held on 6 April at the University of Southampton, under the chairmanship of Dr P. Bosworth, Dr G. F. C. Barrett, of the Du Pont Co. (United Kingdom) Ltd, gave a lecture entitled 'Recent Developments in Delrin.' Dr Barrett introduced the chemistry and history of the development of polyacetal resins. Eighteen years ago Du Pont began the study of polymers of very pure formaldehyde, which had the desirable properties of thermal stability and high molecular weight. The chain consists of $-CH_2O-$ units and the resultant hydroxy end-group on esterification gives better polymers of improved thermal stability. The chain is formed by an ionic polymerization and a variety of acids and bases have been used in this reaction, which is usually carried out in an inert solvent at low temperatures.

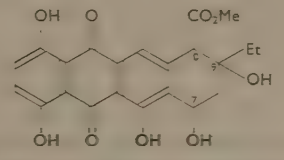
Delrin combines rigidity—not obtained at the expense of toughness—high tensile strength, good elongation with no yield point at normal temperatures, high impact strength, good low temperature characteristics and low water absorption and resistance to fatigue. On a strength/weight basis, Delrin compares favourably with die-cast zinc or cast iron and is used extensively for metal replacement in a wide range of industries. The processing of the material was described next. The finished polymer can be welded, machined or nailed, but no truly satisfactory adhesive has been found that gives a bond-strength approaching the ultimate strength of the material. Dr Barrett displayed a variety of mouldings, and concluded by using these to show many applications, from car door-handles to aerosol bottles. The lecture was well illustrated by slides, and after questions the vote of thanks was proposed by Mr D. H. Bell.

SOUTH-WESTERN COUNTIES

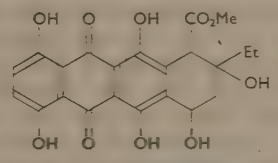
New Family of Antibiotics. A lecture was given by Dr W. D. Ollis at the University of Exeter on 24 February entitled 'A New Family of Antibiotics.' Mr T. W. Parker was in the Chair.

The researches of Brockman (Göttingen), Prelog (Zürich), and Ollis and Sutherland (Bristol) have shown that quite a large number of antibiotic substances of closely related structures are produced by various Actinomycetes. The antibiotics are basic nitrogenous glycosides that on acid hydrolysis give aglycones, dimethylamino sugars, and in some case deoxy-sugars. The aglycones are tetracyclic compounds containing either 1,8-dihydroxy-, 1,4,5-trihydroxy- or 1,4,5,8-tetrahydroxy-anthraquinone residues.

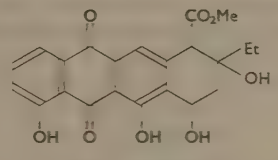
Structural investigations have established that rutilantinone, the aglycone corresponding to rutilantin, has the structure (I) and rutilantinone has been shown to



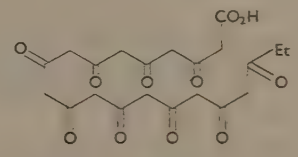
(I) ϵ-Pyrromycinone (Rutilantinone)



(II) ϵ-Isorhodomycinone



(III) Aklavinone



(IV)

be identical with ϵ-pyrromycinone, the aglycone of cinerubins A and B, and pyrromycin.

Other members of this series include ϵ-isorhodomycinone (II), investigated by Brockman, aklavinone (III), studied by the Bristol group, and compounds related to the structures (I), (II) and (III), but lacking the benzylic hydroxyl group in position 7.

Tracer studies with radio-labelled acetate and propionate have shown that the biosynthesis of these compounds may be schematically represented as shown in (IV). The biosynthesis of ϵ-pyrromycinone is the first example of propionate incorporation in the biosynthesis of a phenolic natural product, but biosyntheses of other types of natural product involving propionate have recently been established. The proposed biogenetic route (IV) leading to these compounds accounts very satisfactorily for the interrelationships that exist among the structures of the aglycones of this new family of antibiotics.

Studies of the stereochemistry at C_7, C_9 and C_{10} (I) and the preliminary investigation of the structure of rutilantin were also described.

The vote of thanks was proposed by Dr K. Schofield.

STIRLINGSHIRE AND DISTRICT

Annual General Meeting. The eleventh A.G.M. was held on 23 March in the Refinery Recreation Hall, Grangemouth, under the Chairmanship of Mr G. C. Bailey. The Honorary Secretary and Treasurer's Report for 1960-61 was presented; it described in some detail the activities of the Section, particularly in connection with educational matters. The following were elected Officers and Members of Committee for the 1961-62 Session: Chairman, Mr G. C. Bailey; Vice-Chairman, Dr F. S. Fowkes; Hon. Secretary-Treasurer, Mr R. W. Rae; Members of Committee, Drs J. F. McGechen, A. McLean and M. A. Pyke, F.R.S.E., and Messrs J. F. Cunningham, L. I. K. Ebbutt and R. Nicol.

The business meeting was followed by a lecture on 'The Production and Application of Synthetic Rubber' by Mr K. G. Burridge.

DECCAN

Annual General Meeting. The eleventh A.G.M. of the Section was held on 28 January in the General Chemistry Lecture Hall of the Indian Institute of Science, Bangalore. The Chairman, Professor M. R. A. Rao, welcomed and introduced Professor P. S. Sarma, Professor of Biochemistry at the Indian Institute of Science, who delivered an address on 'Interrelationship between Tryptophan and Nicotinic Acid.'

In introducing his subject, Professor Sarma made a brief reference particularly to the essential amino acids and B-group of vitamins. He then gave an account of the growth and present state of knowledge of the interrelationship between tryptophan and nicotinic acid. Some of the points were explained with the aid of slides.

The vitamins, which are necessary growth factors, are generally obtained from food and it is only in recent years that evidence has been obtained to show that some vitamins can be formed from certain amino acids. The work of du Vigneaud and others has indicated that the methyl group of choline can be obtained from the amino acid, methionine. But the most significant advance occurred in 1945; nutrition experiments with albino rats showed that tryptophan, an amino acid, can give rise to the vitamin, nicotinic acid. Since that time, this interrelationship between an amino acid and a vitamin has been observed in many experimental animals and even in man. Further, by use of ^{14}C-labelled compounds it has been found that tryptophan gives rise to nicotinic acid through a series of intermediate compounds; that the process of conversion is mediated by several enzymes; and that some members of the B-group of vitamins, such as thiamine, riboflavin and pyridoxine, act as coenzymes and influence this interrelationship.

It has been established that in higher organisms such as the rat and man, the pyridine nucleotide biosynthesis follows the nicotinic acid pathway:

Nicotinic acid + 5-phosphoribose pyrophosphate → Deamido nicotinamide-mononucleotide (deamido NMN + pyrophosphate)

Deamido NMN + ATP → Deamido DPN + pyrophosphate

Deamido DPN + glutamine + ATP → DPN + glutamate + AMP + pyrophosphate

A highly active nicotinamide deamidase in various micro-organisms, such as *L. arabinosus*, *S. cerevisiae*, *Neurospora crassa*, *Aspergillus niger*, and in insects like the larvae of *Corcyra cephalonica* st., which splits nicotinamide to nicotinic acid, has been detected. This further shows that the nicotinic acid pathway is operative in these organisms as well. In the mould, *A. niger*, tryptophan and its metabolic products, such as kynurenine, quinolinic acid and β-alanine, have also been found to be utilized for the formation of pyridine-nucleotides in addition to nicotinic acid and its amide.

Mr C. Varadhan proposed the vote of thanks.

After the address the business meeting was held. Officers and Members of Committee were elected as already reported in *J.*, 199. Dr C. N. R. Rao and Mr H. Shiva Rau were elected Hon. Auditors. The business meeting terminated with a vote of thanks to the Chair and the retiring members of the Committee proposed by Mr D. Range Gowda.

The proceedings for the evening concluded with a dinner and a film show at New Krishna Bhavan, Malleswaram, Bangalore. 'Operation Khedda' showed the capturing of wild elephants from the thick forest in the Mysore District. It presented a thrilling spectacle of the magnificent pageantry of herds of wild animals being driven and chased through the river, and eventually trapped and roped with the help of trained tribal people and tamed elephants in a specially constructed circular arena or stockade built of logs. The taming and training of these animals was later shown. 'Spring

Comes to Kashmir' indicated the charming surroundings in which the people travel in boats along waterways as part of their normal activity, and the colourful scenery, with an amazing variety of beautiful flowers. 'Radha Krishna' depicted the ancient Indian legend with its allegorical significance: Radha, the beautiful milkmaid symbolizing the heart of man, yearning for the divine lover, the cowherd god, Krishna. The plays and pranks of Lord Krishna were shown in a series of exquisite miniature paintings, accompanied by melodious songs.

Finally, Dr S. C. Pillai thanked Mr Gavirayappa and his associates of the Bangalore Branch of the Field Publicity Organization of the Government of India, who had kindly shown the films.

Organic Chemical Industry in India. On 24 February Professor N. R. Kuloor, Professor of Chemical Technology and Chemical Engineering at the Indian Institute of Science, Bangalore, delivered a lecture on 'Raw Materials for Basic Organic Chemical Industry in India.' The meeting was held at the Indian Institute of Science. Dr B. H. Iyer was in the Chair.

Professor Kuloor began by referring to the allocation of a sum of Rs. 2,500 crores for investment in the development of a major group of industries and minerals during India's third Five Year Plan. Of this amount, Rs. 650 crores would be for the chemical industries; the new investment in organic chemical industry would be of the order of Rs. 200 crores.

The existing basic organic chemical industry in India is small, and there is now an opportunity to plan this industry and develop it in an integrated manner, utilizing the co-products and by-products as raw materials for other manufacturing processes for the general industrial advancement and economic progress of the country.

The basic raw materials available for the manufacture of organic chemicals can be grouped into two main categories: those derived from exhaustible natural deposits like coal, petroleum and natural gas, and synthetic products like calcium carbide, urea and acetylene produced from them; and those derived from the vegetable kingdom, perennial in nature, such as furfural, alcohol, glycerol, sugar, vegetable oils and oleoresins.

Professor Kuloor then examined in some detail the various available raw materials, the cost and economical processes available for the manufacture of a wide variety of heavy organic chemicals from each one of them. To illustrate the choice of raw materials, he gave a cost analysis for the production of ethylene, ethylene dichloride and vinyl chloride. The lecture was illustrated with slides.

Dr S. C. Pillai proposed the vote of thanks.

Hydroboration. At a joint meeting with the Organic Chemistry Colloquium of the Indian Institute of Science held on 23 March at the Indian Institute of Science, Bangalore, Dr M. V. Bhatt, of the Department of Organic Chemistry, delivered a lecture on 'Hydroboration as a Synthetic Tool in Organic Chemistry.' Professor D. K. Banerjee presided.

The observation of H. C. Brown and B. C. Subba Rao (*J. Amer. chem. Soc.*, 1956, **78**, 5694) on the facile and almost quantitative addition of diborane to carbon–carbon double bonds in ether solvents to yield organoboranes, which has been termed hydroboration, has opened up a new chapter in the chemistry of organoboranes and their use in organic synthesis. The addition takes place specifically with *cis*-stereochemistry, in the anti-Markownikoff fashion, and generally from the less-hindered side of the molecule. Oxidation of the organoborane with hydrogen peroxide results in the unique *cis*-hydration of the double bond with the addition of the hydroxyl group to the less substituted carbon atom. Heating the organoboranes to about 150° in ether solvents results in the migration of the boron atom from an internal to the terminal position in acyclic compounds, and from an endocyclic to normally a less-hindered position outside the cyclic system. Subsequent oxidation of the boron derivative results in the formation of a terminal alcohol.

If the isomerized organoborane is treated with an olefin and distilled, boron is transferred to the added olefin and an isomer of the original olefin is set free. This sequence of reactions, *viz.* hydroboration, isomerization and displacement would lead to a contra-thermodynamic isomerization of olefins, *i.e.* conversion of an internal olefin or an endocyclic olefin to a thermodynamically less stable terminal or exocyclic isomer. For example, 3-ethyl-2-pentene has been converted to 3-ethyl-1-pentene, and α-pinene to β-pinene. The organoborane can also be treated with an organic acid, such as acetic acid, to effect hydrogenolysis or deuterolysis and obtain a saturated hydrocarbon. This reaction provides an interesting procedure for *cis*-hydrogenation or monodeuteration of double bonds. Oxidation of the organoboranes with silver oxide results in the synthesis of saturated hydrocarbons, akin to Wurtz synthesis. Thus, for example, 1-ocetene can be hydroborated and treated with silver oxide to achieve a synthesis of normal hexadecane. Reaction of organoboranes with mercuric oxide results in their facile conversion to organomercurials.

These few examples do not exhaust the applicability of organoboranes in synthesis but indicate their scope and versatility. Indeed, the hydroboration provides a simple route for the preparation of stereochemically-defined products for which there is no direct method of synthesis; it can effect useful transformations in organic compounds that, till now, were not feasible.

Dr B. H. Iyer proposed the vote of thanks.

Herbicides. On 21 April a joint meeting with the Society of Biological Chemists, India, was held at the

Indian Institute of Science, Bangalore. Dr B. H. Iyer took the Chair, and introduced Dr K. M. Srinivasan, Technical Officer, Agr-Ind Private Ltd, Bangalore, who spoke on 'Plant Regulators with Special Reference to Herbicides.'

Dr Srinivasan said that plant regulators are organic compounds (other than nutrients) which, in small amounts, promote, inhibit or otherwise modify any physiological process in plants. They are used in agriculture for encouraging rooting, controlling flowering, inducing fruit-setting, preventing pre-harvest drop of fruits, hastening maturity and ripening of fruits, inhibiting sprouting, controlling weeds and so on.

Plant regulators act as selective herbicides by disorganizing certain biochemical processes within the plant. The factors that influence the herbicidal effectiveness of plant regulators include their concentration, time and method of application, formulations used, plant species sprayed and their stage of growth, and the environmental conditions.

The three plant regulators commonly used as herbicides are 2,4-D, MCPA and 2,4,5-T. They are used in the form of salts, amines and esters. In effectiveness esters come first, followed by amines and salts. A variety of plant regulators used today for herbicidal purposes are largely derivatives of phenoxyacetic acid. It should also be noted that compounds other than plant regulators are also employed as herbicides. The structure of the compound has apparently no relation to its herbicidal activity.

The lecturer stated that plant regulators as herbicides are becoming popular, as it is safe and economical to use them under field conditions, and as commercial production is possible. The agriculturists in India now appreciate chemical weed control; nearly 100 tons of 2,4-D sodium salt are used annually for weed control, and the indications are that its annual consumption will have risen to about 1,000 tons by 1965. Manufacturing units for the plant-regulator type of herbicides are being set up in the country. Dr Srinivasan therefore welcomed the opportunity of discussing the subject at the meeting.

Mr B. R. Das proposed the vote of thanks.

In addition to reports already published, accounts of the following lectures have also been received: 'Problems of Rice Production,' by Dr K. Ramiah (23 September, 1960); 'Inorganic Fluorine Compounds in Chemical Industry,' by Dr A. R. Vasudeva Murthy (7 October, 1960); and a Film Show (14 October, 1960).

MADRAS

On 18 April a meeting was held at the Madras Medical College, when Dr A. R. Natarajan, director of the Madras State Forensic Science Laboratory, spoke on 'Some Recent Advances in Forensic Science.' At the outset Mr N. Pitchandi, Hon. Secretary of the Section and additional director of the Madras State Forensic Science Laboratory, said that members of the Institute have always evinced interest in the development of forensic science, as shown by the fact that almost every month some Section has an aspect of forensic science as the subject for its meeting.

Dr Natarajan confined his remarks to toxicology, and in that subject only to insecticides and fungicides. After the end of the second world war, the complexion of poisoning in India had completely changed. The usual arsenic, mercury chloride, nitrite, cyanide, opium and nux vomica are becoming very rare, and in their place the synthetic chemicals of the organo-phosphorus group and the halogenated aryl and alicyclic compounds are being abused by the criminal underworld. In the field of organo-phosphorus compounds the forensic scientist is mainly concerned with parathion, malathion and Basudin-Diazinon; among the halogenated organic compounds, the laboratory has to deal with DDT, B.H.C. and the endrin and dieldrin group. Methods for the detection and estimation of these substances were described, together with accounts of the ways in which certain of the methods were being developed in the Madras Laboratory.

Mr K. V. Sundaram Ayyar, who presided, thanked Dr Natarajan for his interesting lecture.

Works Visit. On 30 April a party of members and friends visited the Shaw Wallace fertilizer, glue and sulphuric acid factories at Avadi, about 14 miles from Madras. The party first toured the fertilizer factory, where superphosphate was being manufactured from the raw material obtained from the Middle East. Later members visited the glue factory, where glue is produced from tannery waste, and lastly the sulphuric acid factory, which uses sulphur from America as the raw material.

WESTERN INDIA

Industrial Aspects of Dust. Mr W. R. Thompson, works manager, Glaxo Laboratories (India) Ltd, Bombay, addressed the Section on 'The Industrial Aspects of Dust' on 24 March. Dr A. M. Tyabji was in the Chair. Mr Thompson dealt with the incidence of dust in various chemical industries and discussed settling rates, flocculation rate, wetting power, electrical and optical properties. He referred to the methods adopted for dust sampling, for making dust counts and determination of particle size. Discussing the effect of dust on the human system, he mentioned the various pulmonary diseases, such as silicosis, asbestosis, pneumoconiosis, anthracosis and so on. He then detailed the different industrial units—separators, filters, electric precipitators, washers and scrubbers—which are widely adopted for the removal of dust.

The lecture was followed by an interesting discussion on the sources of error in the sampling of dust, possibilities of the incidence of smog in tropical climates and the legislation in India regarding atmospheric pollution.

News and Notes

EXHIBITIONS AND COURSES

Chemical Engineering.—A Summer School in Chemical Engineering will be held at the College of Technology, Huddersfield, on 10–14 July, and will consist of a full-time course of lectures and practical work in the laboratories on 'Mass and Mass-heat Transfer Operations.' The course is intended for those interested in the design and operation of plants in the fields of absorption and stripping; air conditioning, drying and gas/water cooling; distillation; and condensation of vapours. The minimum entry requirement is a degree or H.N.C. in engineering or science, or an equivalent qualification. The fee for the course is five guineas. Applications should be made not later than 20 June to the Registrar, College of Technology, Queen Street South, Huddersfield.

International Plastics Exhibition.—Lord Hailsham, Minister for Science, is to open INTERPLAS 61 at Olympia at 12 noon on 21 June. This event, the Sixth International Plastics Exhibition and Convention, takes place from 21 June to 1 July.

Laboratory Apparatus and Materials.—As already reported (*J.*, 152), the second national Laboratory Apparatus and Materials Exhibition is to be held on 19–22 June in the Royal Horticultural Society's New Hall, Westminster. Among the scientific lectures to be given are those on recent advances in forensic laboratory techniques; laboratory workshops; the Weisz ring-oven techniques in microchemistry; and the examination of food additives.

Toxic Hazards.—A Postgraduate Course in Industrial Safety has been arranged for 19–23 June at the Imperial College of Science and Technology, Department of Chemical Engineering and Chemical Technology. The course, arranged by Dr J. H. Burgoyne and Dr V. D. Long, will consist of lectures on toxic hazards, and will deal in a fundamental manner with the spread, detection and removal of toxic materials liberated in the working environment. Guest lecturers are Mr S. G. Luxon and Dr G. Nagelschmidt. The fee for the course is eight guineas; applications for admission should be made to the Registrar, Imperial College, London, S.W.7.

MEETINGS AND CONFERENCES

Feigl Anniversary Symposium.—An international symposium on analytical chemistry, organized by the Midlands Section, Society for Analytical Chemistry, will be held in Birmingham on 9–12 April, 1962, in honour of Professor F. Feigl, to commemorate his seventieth birthday. The symposium secretary is Mr M. L. Richardson, c/o John & E. Sturge Ltd, Lifford Chemical Works, King's Norton, Birmingham, 30.

Food Technology.—The First European Symposium on Food Technology, the 34th Event of the European Federation of Chemical Engineering, will take place in Frankfurt on 19–20 October. Principal lectures will include those on food technology as an example of process engineering; food additives and uniformity in international food legislation; and physiological effects on nutrition of the processing of foods; in addition, several short papers will be read. Further information may be obtained from the Secretariat, DECHEMA, Frankfurt (Main) 7, Postfach 7746, Germany.

Freeze-Drying of Foodstuffs.—A symposium on the freeze-drying of foodstuffs will be held at the department of chemistry and food technology, Borough Polytechnic, on 19–20 October. The symposium will deal with the development of freeze-drying techniques, a survey of the commercial equipment at present available and a discussion of the potentialities of the techniques in various branches of the food industry. Nutritional aspects will also be included. The panel of lecturers will include a number of persons who were concerned with the development of A.F.D. at Aberdeen and others who are at present installing and operating commercial equipment. Pilot plant and model freeze-drying equipment, samples of freeze-dried products and packaging materials will be on display. Further details may be obtained from the Secretary, Borough Polytechnic, Borough Road, London, S.E.1.

Gas Chromatography.—The Fourth International Symposium on Gas Chromatography, organized by the analytical chemical division of the Gesellschaft Deutscher Chemiker and the gas chromatography discussion group of the Hydrocarbon Research Group of the Institute of Petroleum, being also the 41st meeting of the European Federation of Chemical Engineering, will be held at Hamburg from 13 to 16 June, 1962. The main language of the meeting will be English, and the papers presented will be classified under three headings: theory; apparatus and techniques; and applications. Papers concerning applications and techniques must have some novel feature to warrant their inclusion in the programme. Preliminary registration for attendance at the symposium should be sent as soon as possible to Gesellschaft Deutscher Chemiker, c/o Dr W. Fritsche, Frankfurt (Main), Postfach 9075, Germany.

Graphite-Moderated Reactors.—The Institute of Physics and the Physical Society, in collaboration with the British Nuclear Energy Conference, is sponsoring a symposium on 'The Physics of Graphite-Moderated Reactors' to be held in Bournemouth on 4–6 April, 1962. The provisional programme includes a half-day

visit to the Atomic Energy Establishment at Winfrith, Dorset. The symposium is intended particularly for the less senior members of research and development staffs working in this field. First preference to attend will be given to members of the constituent bodies of the British Nuclear Energy Conference. Communications about the symposium should be addressed to the Secretary of the Institute and Society, 47 Belgrave Square, London, S.W.1.

National Society for Clean Air.—The 28th Annual Conference and Exhibition of the National Society for Clean Air will be held in Brighton on 4–6 October. It will be opened by the Parliamentary Secretary to the Ministry of Power, Mr John George, M.P., and a first Presidential Address will be given by the Rt Hon. Lord Cohen of Birkenhead. A new feature will be a trans-atlantic discussion, by telephone, on air pollution problems between a Conference panel and a panel of experts in the U.S.A. The registration fee is three and a half guineas. Registration forms and further details may be obtained from the Director of the Society, Field House, Breams Buildings, London, E.C.4, and should be returned before 15 August.

Packaging in the Cosmetic Industry.—A symposium on 'Packaging in the Cosmetic Industry', organized by the Society of Cosmetic Chemists of Great Britain, will be held at the Old Swan Hotel, Harrogate, on 5 July. The contributors are Messrs A. Herzka, C. E. Morris, F. W. Noble, C. Tarrant and E. H. Walls. It is intended to despatch pre-prints of the lectures to all participants. All arrangements are in the hands of Mr R. F. L. Thomas, c/o Joseph Watson & Sons Ltd, P.O. Box No. 167, The Whitehall Works, Leeds, 1.

Research Methods and Instrumentation.—The 11th Annual Instrument Symposium and Research Equipment Exhibit will be held at the National Institutes of Health, Bethesda, 14, Maryland, U.S.A., on 9–12 October. Topics for discussion in the scientific programme of the symposium, 'Recent Developments in Research Methods and Instrumentation,' include applied gas-chromatography factors influencing interpretation of spectra; electron magnetic resonance; thermogravimetric analysis; electron probe analysis; application of physiological instrumentation to clinical problems, and optical rotatory dispersion. The Executive Secretary is Mr J. B. Davis, of the National Institutes of Health.

Space Technology.—The British Interplanetary Society has arranged a symposium on Space Technology to be held at the Federation of British Industries, 21 Tothill Street, London, S.W.1, on 26–28 June. Registration is necessary, and further information and application forms may be obtained from the Secretary of the Society, Mr L. J. Carter, 12 Bessborough Gardens, London, S.W.1.

RECENT PUBLICATIONS

Gmelins Handbuch.—Three new items in the series have been announced.

System No. 9. Sulphur, Part B, Section 2 (Cloth, DM 471).

System No. 20. Lithium, Supplement Volume (Cloth, DM 330).

System No. 34. Mercury, Section 1 (Wrappers, DM 283).

These contain German and English indexes and English headings and sub-headings in the margins. They are obtainable from Verlag Chemie, GmbH, Weinheim/Bergstrasse, Germany.

NATIONAL LENDING LIBRARY

The library buildings at Boston Spa, Yorkshire, are nearly complete. The D.S.I.R. Lending Library Unit is therefore being wound up, and the *LLU News* will be replaced by the *NLL News*, to be issued as occasion demands. The last issue of the *LLU News* (April) says that the Chester Terrace Reading Room is now closed; until 30 June would-be readers are asked to inquire whether the literature they require is still available at Chester Terrace and whether it may be seen by arrangement. Telephone inquiries should be made to HUNter 8361, extensions 22 or 16. In general, no serial literature dated 1961 is held at Chester Terrace. The Reading Room at Boston Spa will probably be open at the beginning of September.

Borrowers can help to reduce some of the difficulties of the transfer to Yorkshire by giving the fullest possible references for items required and returning publications borrowed as quickly as possible to the address from which they were issued, unless specifically requested to do otherwise. No photocopy service is yet available for publications held at Boston Spa. Requests for the loan of material should be sent to: National Lending Library, Boston Spa, for all serial literature previously available from the LLU at Stanmore and all 1961 copies of serials with foreign language titles; to the LLU, Chester Terrace, Regents Park, N.W.1, for literature from the U.S.S.R. and translations of this literature, excluding 1961 issues of serials, the 'PB' reports issued by the Office of Technical Services of the U.S. Department of Commerce, and the reports on German industry produced by the BIOS, CIOS and FIAT agencies, mainly in 1946–48; and to the Science Museum Library, South Kensington, London, S.W.7, for all other literature. Correspondence and inquiries other than loan requests should be sent to 20 Chester Terrace until 15 July.

CORRESPONDENCE

Chemical Bond Approach

Sir,—I was very pleased to read the letter by Dr Jepson and his colleagues in the April issue of the *Journal* (*J.*, 156). The Chemical Bond Approach represents a significant advance in methods of teaching chemistry and the results of this trial course should be extremely interesting. Nevertheless, I would not advise complete adoption of this method in British schools.

In the American high school, chemistry is introduced when the pupils are 17. At this stage the student is of sixth-form level and well-equipped intellectually to approach bonding from the orbital viewpoint. This would equally apply to Dr Jepson's First M.B. students. It is, however, questionable whether this approach is of much value in the 14–15 year age group. Certainly at 'A' level the rigid 'double dot' picture of the chemical bond should be expanded as described earlier (*J.*, 3).

Mathematics also tends to move at a slower pace in the American high school than in Britain, and the C.B.A. texts are accordingly phrased in a non-mathematical fashion. British and European teachers would probably prefer to use mathematical descriptions where appropriate. Again, in medical schools, non-mathematical descriptions might be preferable wherever possible.

There is also an unfortunate preoccupation with the Pauling Atomic Model in the Chemical Bond Approach. Orbital diagrams tend to be introduced as 'the last word' rather than as the present state of knowledge on atomic structure. In this connection it is rather disturbing to read the summary treatment of 'Ligand Field Theory' in the third edition of *The Nature of the Chemical Bond.*

My references to equivalent and electron transfer were interpretations not of C.B.A. (as suggested by Dr Jepson and colleagues) but of European developments. Scandinavian countries, with their rich heritage in the physical chemistry of solutions, introduce modern ideas of acid–base theory and pH at an early stage. In Switzerland electronegativity and electron transfer concepts are very widely used. My statement that 'the concept of equivalent becomes superfluous' referred specifically to the elementary chemistry syllabus in schools. At present teachers tend to determine the equivalents of magnesium and copper by a multiplicity of time-consuming methods. Surely it is better to introduce equivalent weight later as a consequence of Faraday's Laws, and the excellent electron-transfer definition proposed by the writers becomes a logical consequence. The two cases of oxidation—acetaldehyde–acetic acid; ferrous–ferric—are surely examples of the same phenomenon occurring, on the one hand in a predominantly covalent system and on the other in one which is significantly ionic. The oxygen atom as acceptor of an electron pair provides the vehicle for the electron transfer in the first case, but in covalent systems of this type the transfer is not well marked.

Together with Dr Jepson and his colleagues, I am interested in hearing from others who are experimenting with new methods of teaching chemistry. In Britain, however, as in Ireland, any new method must be devised to suit home needs, and it is questionable whether any single syllabus used abroad should be accepted in a totally unchanged form.

E. J. Rothery

Department of Pure and Applied Science,
College of Technology,
Kevin Street, Dublin

Needless Terminology

Sir,—A short time ago I had an opportunity of talking to teachers of chemistry on the superfluity of such terms as 'atomic weight,' 'molecular weight,' 'equivalent weight,' 'equivalent' and 'normality.'[1] Others support these views. Professor E. A. Guggenheim recently wrote: 'In particular it is hoped that the term "atomic weight" may fall into disuse so that eventually it may become unnecessary to explain to every novice that "atomic weight" does not mean the weight of an atom.'[2] Professor C. C. Addison and other speakers at the Symposium on the Teaching of Inorganic Chemistry at Pre-University Level, held by the Institute at Liverpool on 15 April, hoped to see the abolition of 'equivalent' and 'normality' from the teaching of chemistry. The word 'equivalent' has no place at all in the *Chemistry for Grammar Schools* report.[3]

It therefore surprises me when a progressive group of teachers express their opinion that: 'Firstly, the remark that the concept of *equivalent* becomes superfluous cannot be supported,'[4] and leads me to offer an analysis in terms of quantity calculus.[5] The following set of related equations concerns the controversial terms:

$$\text{'molecular weight'} = z \times \text{'equivalent weight,'} \quad (1)$$

$$\text{'mole'} = z \times \text{'equivalent,'} \quad (2)$$

$$\text{chemical formula} = z \times \text{'equivalent formula,'} \quad (3)$$

$$\text{molarity} = z \times \text{'normality,'} \quad (4)$$

$$M \text{ (or mole/litre)} = z \times \text{'}N \text{ (or equivalent/litre),'} \quad (5)$$

where z is a positive integer which is not a constant in all circumstances. The key to these equations is the chemical formula. For potassium permanganate this is conventionally chosen to be the empirical formula, $KMnO_4$. Once this formula is accepted, it is possible to state that the molar mass of $KMnO_4$ (not of potassium permanganate) is $M = 158{\cdot}03$ g/mole $KMnO_4$. The 'molecular weight' of $KMnO_4$ is 158·03, a mole of $KMnO_4$ is the amount of potassium permanganate in 158·03 g, and a potassium permanganate solution whose molarity (or molar concentration) is

0·1 *M*-$KMnO_4$ is one which contains 0·1 mole $KMnO_4$/litre. Of the terms which appear on the left-hand sides of equations (1) to (5) only 'molecular weight' is redundant. These equations enable the terms on their right-hand sides to be obtained as soon as the integer z is known. The most modern way of deciding which value of z shall be used is that which defines an 'equivalent' as the molar amount (or proper amount[2]) of a substance which is involved in the transfer of 96,500 coulombs either as electrons or as protons.[6] For a given chemical formula, like $KMnO_4$, the value of z depends upon (*a*) whether the transfer of 96,500 C takes place as electrons or as protons, and (*b*) what other changes accompany the charge transfer (*see* Table).

TABLE

VALUES OF z IN SOME REACTIONS OF $KMnO_4$

Transfer	Product	z
Electron	MnO_2	3
Electron	Mn^{3+}	4
Electron	Mn^{2+}	5
Proton	Mn^{2+}	8

For any of the changes tabulated, it is possible to obtain the corresponding 'equivalent weight,' 'equivalent,' 'equivalent formula' and 'normality.' Thus, if $z = 4$, a potassium permanganate solution whose molarity is 0·1 *M*-$KMnO_4$ is one whose 'normality' is 0·4 *N*-($KMnO_4$/4). It is quite misleading and erroneous to write that this solution is 0·4 *N*-$KMnO_4$ or 0·4 *N*-potassium permanganate. Such a statement is without meaning until the 'equivalent formula' ($KMnO_4$/4 in the example) is given. Since, for complete clarity, a chemical formula or an 'equivalent formula' must always be stated whenever a concentration is expressed in terms of the mole or 'equivalent' concepts, it is quite unnecessary and confusing to use both.

All quantities on the right-hand sides of equations (1) to (5) are superfluous when properly used, ambiguous when carelessly used, and constitute a good example of the unnecessary multiplication of entities which William of Ockham's razor so soundly condemns.

G. N. COPLEY

Education Offices,
14 Sir Thomas Street,
Liverpool, 1

REFERENCES

1. G. N. Copley, 'Gulliver in the Land without Atomic Weights.' A talk given at A Short Course for Teachers of Chemistry, held at Bradford Institute of Technology, on 25 March.
2. E. A. Guggenheim, *J. chem. Educ.*, 1961, **38**, 86.
3. Science Masters' Association and Association of Women Science Teachers. London: John Murray (Publishers) Ltd, 1961.
4. W. F. Coulson, J. B. Jepson and D. G. O'Sullivan, *J. R. Inst. Chem.*, 1961, **85**, 157.
5. G. N. Copley, *J. R. Inst. Chem.*, 1959, **83**, 477; *Nature*, 1960, **188**, 254.
6. The curious definition of 'equivalent' given in reference 4 is not followed.

LABORATORY RISKS AND SAFEGUARDS

Opening of Sealed Ampoules

SIR,—I am prompted by the recent correspondence on ampoules to record my own views on this method of packaging and upon opening them without danger.

Step-wise cooling (ice, ice–salt, solid carbon dioxide) before opening is recommended to reduce internal pressure. Carbon dioxide cooling is unnecessary and in fact a potential cause of accidental shattering. A glance at tables of vapour pressures and at typical gas solubility curves will show that systems with pressures of the order of one atmosphere at −79°C show such high pressures at room temperature that a glass ampoule could not possibly contain them. Immersion in aqueous freezing mixtures is to be avoided if the contents of the ampoules are known to react vigorously with water. Placing the ampoule inside a beaker in the refrigerator a few hours before opening, transferring it to the freezing compartment if necessary, pre-cools the ampoule sufficiently. The temperature difference between an ice–salt and a solid carbon dioxide freezing mixture is so large that a thick soft-glass ampoule may be cracked by thermal shock.

To equalize pressure before opening, it is convenient to heat the tip of the stem with a small blowtorch flame while the ampoule is behind a shield, or, preferably, behind the shatterproof glass of the fume hood. The glass may blow out, suck in or crack. In any event the ampoule may now be safely cut open with a file. The ampoule design with a constriction in the stem facilitates a clean break at this point, but is inconvenient for re-sealing.

Ampoule packaging will be with us for some time in some fields but will be superseded in others. It is excellent for aqueous solutions and sterile preparations like antibiotics, especially in small quantity, which are used all at once and not stored or re-sealed. It is not so good for corrosive and hazardous chemicals such as bromine and phosphorus trichloride but has been adopted in many instances because of difficulties with alternative methods of closure. Ground-joint stoppers stick, and screw caps are attacked by the reagent and leak. A major advance in packaging such substances, recently adopted commercially, is use of a Kel-F screw cap. This fluorocarbon plastic is chemically inert towards a remarkable variety of most corrosive chemicals, does not stick like a glass stopper and makes a tight seal. The bottle may be reopened repeatedly, of course, and does not evolve vapour. The horrible task of opening a one-pound ampoule of bromine or sulphuryl chloride may soon be a thing of the past.

D. G. M. DIAPER

Department of Chemistry,
Royal Military College of Canada,
Kingston, Ontario

OBITUARY

William Harrison Brindley. *B.* 20.10.1888. *Ed.* University of Cambridge, 1918–20. M.A.(Cantab.), M.Sc.Tech., Hon. M.Sc., Ph.D.(Manc.). His education was interrupted by service in H.M. Forces, 1914–18, during which time he reached the rank of lieutenant and was awarded the M.C. He became a demonstrator in chemistry at the College of Technology, Manchester, in 1920. He was appointed assistant editor by the Society of Chemical Industry in 1930, and remained there for two years before returning to the College of Technology, Manchester, as a demonstrator in applied chemistry. In 1936 he was appointed librarian and intelligence officer at the Manchester Oxide Co. Ltd, and a year later joined Hardman & Holden Ltd as librarian, a post which he held until his retirement in 1954. Latterly he served the Manchester Literary and Philosophical Society as Honorary Librarian (*see J.*, 1955, 62). (*A.* 1924) *D.* 14.1.61.

Frank Ward Bury. *B.* 18.4.1888. *Ed.* Owens College (now the University), Manchester, 1906–09. B.Sc. He began his career as a science master at Hebden Bridge Secondary School in 1909, and held similar posts successively at the County School, Port Talbot, 1911; Galway Grammar School, 1913; and Monrose Grammar School, London, 1916. After a short period of military service, he was appointed lecturer in chemistry at East London College (now Queen Mary College) in 1919. M.Sc., 1922. He became an analyst and lecturer in organic chemistry at the London Hospital Medical College in 1933. He served in the Royal Army Medical Corps during the second world war and reached the rank of major. He was discharged on medical grounds in 1942 and returned to his former post, where he remained until 1948 when he retired owing to ill health. (*A.* 1923, *F.* 1933) *D.* 19.2.61.

John Galloway Cowan. *B.* 25.11.02. *Ed.* Aldenham School; Royal College of Science, London, 1920–23, and one further year in the department of fuel technology. B.Sc. In 1925 he was appointed research chemist at the University Grinding Wheel Co. Ltd, Stafford, where he remained for the whole of his working life. At the time of his death he was research manager. (*A.* 1924, *F.* 1930) *D.* 7.12.60.

Bruce Norman Feitelson. *B.* 13.2.25. *Ed.* Ashford Grammar School; University College of the South West (now University of Exeter), 1943–45. B.Sc.(Lond.). He was appointed research chemist at British Drug Houses Ltd in 1946. He left in 1951 to take up a post as research chemist at l'Institut de Sérothérapie Hémopoietique, Paris. Ph.D.(Lond.), 1951. He returned to this country in 1954 on his appointment as senior development chemist, products development department, Parke, Davis & Co Ltd. He returned to France in 1957 to become head of chemical research and development, Les Laboratoires Cassene. Shortly before his death he was appointed director of chemical services, Société Normande d'Extraction et Synthèse, Eure. He was joint author of a number of scientific papers. (*A.* 1946, *F.* 1956) *D.* 4.12.60.

William Harold Keys. *B.* 1882. *Ed.* University of Birmingham, 1898–1902. He joined the Midland Railway Co. (later London Midland and Scottish Railway) as an assistant chemist in 1903. He remained with the company until his retirement in 1946, when he was assistant chief chemist. (*A.* 1903, *F.* 1920) *D.* 7.1.61.

Alexander McDonald. *B.* 4.7.01. *Ed.* Allan Glen's School, Glasgow; Royal Technical College, Glasgow, 1919–23. B.Sc. His first post was as works chemist at the Motherwell and Wishaw Corporation Gas Department, where he later became gas engineer and manager. In 1938 he took a similar post at Castleford and some years later became general manager of the York, Harrogate and District Group of Gas Companies. When the industry was nationalized he was appointed a full-time member of the North Eastern Gas Board, a position which he held at the time of his death. (*A.* 1924) *D.* 23.1.61.

Walter Matthew Madgin. *B.* 21.5.1893. *Ed.* Armstrong College, Newcastle upon Tyne (University of Durham), 1912–15. B.Sc. After graduation, he was commissioned in the West Kent Regiment and in 1916 was transferred to the Special Brigade, Royal Engineers. In 1917 he was appointed Staff Captain to Divisional Headquarters and Divisional Gas Adviser, and served in France until the end of 1918. He returned to Armstrong College (later King's College) in 1919 as a lecturer in chemistry. He was promoted to senior lecturer in 1949, a post which he held until his retirement in 1958. He was awarded the degree of M.Sc.(Durh.) in 1919 and D.Sc. in 1934. His scientific work was concerned with equilibria in solutions and in inorganic salt mixtures, and with phase-rule studies of multi-component systems; he was the author of a number of papers. For many years he was an examiner and later senior examiner in chemistry of the University of Durham Schools Examinations Board. He served as chairman of the Newcastle upon Tyne and North-East Coast Section of the Institute, 1938–39, and as Hon. Treasurer, 1939–47. His main relaxations were gardening and walking, and his extensive knowledge of the countryside, particularly of the byways of Northumberland and Durham, was a delight to his friends. (*A.* 1919) *D.* 16.12.60.

Joseph Crosland Mellor. *B.* 24.2.1893. *Ed.* Kirkcaldy High School; University of Edinburgh, 1913–15; 1919 (interrupted by war service). B.Sc. He joined the Clayton Aniline Co. as a technical chemist in 1920 and remained with them for the whole of his working life. When he retired in 1954 he held the position of assistant technical manager. He was associated with the Huddersfield Hospital Management Committee from 1952 onwards, and was appointed chairman in 1955. He was for a number of years chairman of the Upper Agbrigg Divisional Education Executive and was vice-chairman of Colne Valley High School Governors. In recognition of his public services he was appointed M.B.E. in 1960. He was a great music lover, and his chief pastimes were cricket, bowls and golf. (*A.* 1920) *D.* 27.1.61

Donald Ford Phillips. *B.* 4.6.07. *Ed.* Technical College, Coventry, 1924–25; Birmingham Central College, 1928–30, 1932; Sir John Cass College, London, 1930–31. His first engagement was as chief chemist and metallurgist, Perry Bar Metal Co. Ltd, in 1932. Thereafter he became successively assistant works manager and metallurgist, Kaye Alloy Castings Ltd, 1935; chief chemist and works manager, E. Hind Ltd, 1936; assistant works manager, Light Alloy Products Co., 1939; chief chemist, High Duty Alloys Ltd, 1940; and senior experimental officer, Chemical Inspectorate, Ministry of Supply, 1949. He continued in this post under the U.K. Atomic Energy Authority, and remained there until the time of his death. (*A.* 1948, *F.* 1956) *D.* 2.2.61.

Sidney Arthur Welch. *B.* 26.5.1890. *Ed.* Chelsea Secondary School; University College, London. 1908–11. B.Sc. After leaving college, he taught chemistry and physics at Emmanuel School, Wandsworth Common. In 1916 he became a chemical examiner in the aeronautical inspection department at University College; in 1917 examiner-in-charge, special investigations; and in 1918 deputy assistant inspector. He left the following year to join British Celanese Ltd as a research chemist, and remained with the firm for the remainder of his working life. He was one to whom the man-made fibre industry of this country owes a debt of recognition. He ran the first vertically-downward dry-spinning machines erected at Spondon, which produced yarn that afforded material essential for dyeing research. This introduction may well have brought him to give close study to machine-knitting and in this branch of textiles he became a leading expert. His foresight indicated the importance of 'locknit' and he was the founder of the largest warpknit establishment in this country. He was a liveryman in the Framework Knitters' Guild and a Freeman of the City of London. Endowed as he was with charm of manner and a most pleasant personality, he made and retained many friends among workers, colleagues and leaders in the industry. (*A.* 1918) *D.* 30.9.60.

William Wilde. *B.* 7.9.1881. *Ed.* Accrington Technical School, 1895–98, Accrington and Blackburn Technical Schools, 1902–06, and private tuition. He began his career as an analytical and works control chemist at John Riley & Sons Ltd, Hopton, nr Burnley, in 1895, and in 1913 was appointed works manager, a position which he held until his retirement in 1948.

From then until his death he was retained as a consultant by the firm and later by William Blythe and Co. Ltd when that firm was taken over by John Riley and Sons Ltd. He had a deep knowledge of classical music and was a member of a well-known local orchestra for over 40 years as a violinist. He was also an honorary founder member of the Accrington Clef Club. (*A.* 1918, *F.* 1924) *D.* 30.11.60.

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(C) JONES, Peter, DIP.TECH.
(H) LUCAS, Peter William, B.SC.(BIRM.)
(P) MEEKS, Alan Clifford, B.SC.(S'TON)
(P) RANDALL, Heather Grace, B.SC.(LOND.)
(P) SMITH, Ieuan Trevor, M.SC.(LOND.)
(T) WILLIAMS, John Leslie, D.L.C.

DEATHS

Fellows

(K) COCKBURN, Thomas. Died 21 April, 1961, aged 80. *F.* 1909.
(D) MALKIN, Thomas, PH.D.(MANC.), D.SC.(LOND.). Died 25 April, 1961, aged 63. *A.* 1921, *F.* 1945.
(S) REDPATH, George Christie. Died 28 April, 1961, aged 86. *F.* 1919.

Associate

(P) ALLAM, Philip Sidney, B.SC.(LOND.). Died 29 April, 1961, aged 57. *A.* 1925.

Erratum. In the obituary of Harry Barnes (*J.*, 158) the date of retirement should have been 1960.